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Imaginal And In Vivo Desensitization: An Analysis Of The Role Of Transfer

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IMAGINAL AND IN VIVO DESENSITIZATION: AN ANALYSIS OF THE ROLE OF TRANSFER

by

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ABSTRACT

One important assumption of the systematic desensitization (SD) process is that reductions in the fear response (i.e. autonomic arousal) to phobic imagery achieved during treatment generalize to the actual phobic object. This is a crucial assumption since the dual process theory of conditioned avoidance responding plays an important role in the theoretical rationale for SD and its efficacy. The dual process theory asserts in part that the extinction of the classically conditioned autonomic response to a conditioned aversive stimulus is a necessary and sufficient cause for the extinction of the motor avoidance response to that stimulus. If the generalization of autonomic changes from imagery to actuality does not, in fact, occur then alternative explanations of SD become necessary.

The purpose of the present study was to investigate this generalization. Subjects were 27 female undergraduates who were unable to touch a white laboratory rat. Measures of each subject's motor, cognitive, and autonomic responses to the rat were collected at a pretreatment assessment session. Subjects were each randomly assigned to one of three groups. The first group (SD) was treated by a form of systematic desensitization. The second group received an *in vivo* (IV) treatment. This treatment was the same as SD, except that subjects actually performed rather than imagined items from the

hierarchy. The third group was a no treatment (NT) control group.

Following treatment, subject's fear responses were assessed again. Results indicated that while both SD and IV showed significant motor and cognitive changes, only the IV group showed concomitant physiological changes to the real object. The NT group showed no consistent changes.

The results of the study clearly did not support the assumption of generalization of autonomic decrements from imagery to actuality. While measures taken during SD treatment indicated that subject's level of arousal to a scene decreased with repeated presentation, these decrements were not evident in the presence of the actual object at posttest. It is evident from these results that the assumption of generalization is unwarranted and that dual process principles cannot account for the behavior change which follows the application of SD treatment.

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CHAPTER I

INTRODUCTION

In recent years, perhaps no other therapeutic procedure has inspired as much research as Wolpe's systematic desensitization (SD). Basing his procedure on the principle of reciprocal inhibition, Wolpe (1958, p. 71) stated:

> If a response antagonistic to anxiety can be made to occur in the presence of anxiety-evoking stimuli so that it is accompanied by a complete or partial suppression of the anxiety responses, the bond between these stimuli and the anxiety responses will be weakened.

The "response antagonistic to anxiety" Wolpe selected was muscular relaxation. In systematic desensitization, the subject is relaxed by a procedure based on Jacobson's (1938) progressive relaxation technique. Once a subject is relaxed, he is asked to visualize a scene from a graded list of items relevant to his phobia. The list is arranged in such a way that items which produce less anxiety are presented first, while items which produce more anxiety are presented later. Gradually, the subject moves through the hierarchy of items, relaxing at each one, until eventually he can relax while imagining the last, or most anxiety-evoking item. For a more thorough description of the desensitization procedure, see Wolpe (1969) or Rachman (1968).

While the efficacy of SD has been well documented (see Paul, 1969 a & b) more recent research has concentrated on the mechanics and

principles underlying the procedure. A central problem is the role of autonomic responses in SD. According to Wolpe, muscular relaxation inhibits autonomic arousal, thereby preventing anxiety. Wolpe thus sees the success of SD as dependent on the inhibition and eventual extinction of physiological responses to this phobic stimulus.

While Wolpe has been able to gather some evidence in support of his formulation, additional empirical data are needed in order to assess the validity of his assumptions. In particular, a wide range of data on the peripheral physiological concomitants of SD is necessary to allow for a rigorous assessment of the Wolpian position. It is the purpose of this study to gather such data. However, before presenting the specific hypotheses to be tested by the proposed study, a review of the relevant literature is in order.

Autonomic Arousal and Avoidance Conditioning

Whether or not Wolpe is justified in reducing SD to a physiological level is questionable (Davison, 1968). Indeed, the very role of autonomic arousal in the anxiety response (Fehr & Stern, 1970) and, in particular, in the avoidance response, is a matter of controversy.

Mowrer's (1947) classic exposition of the dual process learning theory amply points out this connection. Simply stated, Mowrer's theory asserts that Pavlovian principles operate in the development of conditioned emotional (i.e., autonomic) reactions, which then serve as motivators or mediators for the development of conditioned avoidance responses. The relevance of the dual process position to Wolpe's theory is that Wolpe sees phobic reactions as conditioned avoidance

responses, and therefore, the elimination of any conditioned autonomic response to the phobic stimulus is clearly a prerequisite for the elimination of the avoidance response per se. Evidence, however, suggests that the relationship between autonomic arousal and avoidance responding is highly complex, and that there may not be a necessary connection at all.

For example, Black (1959) studied heartrate changes in dogs during avoidance conditioning, and found that, during extinction, the avoidance response was still evident long after the autonomic response had extinguished. Wynne and Solomon (1955) studied avoidance learning in dogs whose sympathetic nervous systems were blocked by either surgical or pharmacological means. Results indicated that animals deprived of autonomic functioning required more trials to learn to escape from shock. Nonetheless, they were able to learn the avoidance response.

The evidence cited above threatens Mowrer's dual process theory, and thus the physiological foundation of SD. Alternative hypotheses which emphasize the role of central mediators in the conditioned avoidance response have been proposed by Rescorla and Solomon (1967), Bandura (1969), Valins and Ray (1967), and others. However, these hypotheses also lack sufficient empirical support. In any event, the role of physiological responses during the SD procedure is an area in need of investigation, yet only recently has research in the area commenced.

Relaxation, Systematic Desensitization, and Autonomic Arousal

Wolpe's formulation of SD raises at least three immediate

questions for the researcher. (1) Is relaxation training effective in reducing the level of autonomic arousal? (2) When paired with relaxation, do successive presentations of an imaginal stressful stimulus result in a decrement in the level of the autonomic response to that imaginal stimulus? (3) If the answers to the above questions are affirmative, then does SD result in a decrement in autonomic arousal in the presence of the actual feared stimulus? In other words, are the physiological effects of SD treatment specific or do they generalize to the actual phobic object?

Studies with respect to the first question can be divided into two categories. The first is concerned with the relative efficacy of relaxation training in producing decrements in autonomic arousal. For example, Lader and Mathews (1970) assessed the effectiveness of relaxation training combined with either a short acting barbiturate (Methoexitone sodium) or a placebo saline solution in reducing the peripheral physiological arousal of phobic or anxiety state patients. Although they used several indices of autonomic arousal, they were unable to find any consistent reduction and conclude that physiological measures have "...limited usefulness at such low levels of arousal." In addition, Grossberg (1965) reports a study in which ten Ss were trained in relaxation, ten Ss listened to music, and ten Ss were simply asked to relax. Measures of E.M.G. activity, skin conductance, and heartrate failed to differentiate the groups. Similarly, Edelman (1970, 1971) found that brief muscular relaxation training was no more effective in reducing autonomic arousal than other techniques which theoretically, at least, should have a minimal effect. Nonetheless, even Edelman's "control" treatments resulted in a significant reduction

in heartrate and blood pressure in the former study, and a reduction in skin conductance in the latter study.

The second category, which is of more immediate concern to Wolpe's position consists of studies which have attempted to support the contention that relaxation training is accompanied by a reduction in tonic levels of autonomic functioning. The form of relaxation training usually employed in the desensitization procedure is a briefer form of Jacobson's (1938) rather extensive training in muscular relaxation. Jacobson (1939, 1940) compared blood pressure and pulse rate under conditions of muscle tension and relaxation induced by his technique. He found a decrease in both these measures under relaxation conditions. However, as Mathews (1971) points out, Jacobson's results are of little value due to inadequate control of possibly confounding variables.

Paul (1969c) studied the effects of an abbreviated form of relaxation training on heartrate, respiration rate, muscle tension, and skin conductance. He found that relaxation training was accompanied by a significant decrease in all measures, except skin conductance, when compared to a self-induced relaxation control group. Similarly, Iwakawi (1970) and Mathews and Gelder (1969) reported a reduction in autonomic arousal following relaxation training. Iwakawi reported decreases in heartrate and muscle tension, not in GSR, while Matthews and Gelder found decreases in heartrate and skin conductance, but not in muscle tension or respiration rate. Kleinman (1969) found a significant reduction in basal skin conductance following abbreviated Jacobsonian relaxation training. Mathews and Gelder (1969) trained fourteen patients using the briefer form of Jacobson's technique and tested the

patients during a relaxation session and a control session in which the patient was not instructed to relax. They found in relation to the control session, the relaxation session was accompanied by a decrease in frontalis E.M.G., a lower incidence of skin conductance activity and a greater decrease in the basal level of skin conductance.

Based on the evidence above, it is clear that while relaxation training may not be the most or only effective method of producing decrements in autonomic arousal, it is nevertheless usually accompanied by such decrements. Therefore, Wolpe's contention regarding the presence of these reductions is justified.

Studies relevant to the second question support the contention that there is a decrease in autonomic arousal to imaginal stressful scenes when they are paired with relaxation instructions. In a preliminary study, Wolpe, Lazarus, and Fried (1968) showed a decrease in GSR to phobic scenes as the scenes were successively presented with relaxation instructions. These results support those of Agras (1965) who also found a decrease in GSR during the standard SD procedure. A later study by Wolpe and Flood (1970) dealt with the criticism that successive presentations of the scenes themselves reduced autonomic responding, and that relaxation was unnecessary. In this study, Ss were randomly assigned to one of two groups. One group incorporated relaxation training and instructions with item presentation. The other group received no relaxation training or instructions. Results showed a decrease in GSR to scene presentations for the relaxed group, while no such trend was found for the nonrelaxed group.

While these studies tend to support Wolpe's position, they are

open to serious criticism. First, the use of one index of autonomic arousal is of questionable value (Lacey, 1950, 1959). In particular, the use of GSR as the only measure of autonomic arousal is questionable (Harrison, 1964; Paul, 1969c; Martin & Sroufe, 1970). In addition, there is evidence to suggest that the mere repetition of scenes is accompanied by reduction in autonomic arousal and that the use of relaxation is superfluous (Grossberg & Wilson, 1968; Van Egeren, 1970).

While these criticisms are somewhat attenuated by the findings of Laemmle (1969) who found a decrease in heartrate with the SD of speech anxiety, stronger support for Wolpe's position can be found in a study by Paul (1969d). Paul measured heartrate, respiration rate, muscle tension, and skin conductance in response to stressful imagery. Using composite scores of all the physiological data for each individual, he found that relaxation training and instructions were associated with a decrease in autonomic arousal to stressful imagery. Subjects who did not receive training in relaxation actually showed an increase in autonomic arousal on the final presentation of the scene. Paul's results, then, are supportive of Wolpe and Flood's, but are in apparent contradiction to those of Grossberg and Wilson. Perhaps as Mathews (1971) suggests, procedural differences which are not apparent account for this discrepancy.

Whether or not relaxation training facilitates the inhibition of autonomic arousal to phobic imagery remains an unresolved question. There is, however, little doubt that the physiological arousal to such imagery does decline in a relaxed subject with repeated presentation. Perhaps the strongest evidence in support of this point is supplied in

the recent study by Lang, Melamed, and Hart (1970). They found that when subjects signalled anxiety on a given item, their indices of autonomic arousal would significantly increase, while later presentations of the same scene with no signal of anxiety were accompanied by a decrease in such activity.

The above evidence makes it clear that relaxation training, when paired with stressful imagery, is accompanied by a decrease in autonomic arousal to such stimuli. While these results support Wolpe's theory, it cannot be concluded that there is a necessary causal link between muscular relaxation and the subsequent reduction of physiological arousal. The results of the above studies simply indicate that relaxation and autonomic decrements occur together and in response to formerly arousing imaginal stimuli.

While affirmative answers to the first two questions have considerable empirical support, research on the third question regarding the autonomic response to the actual phobic object is very limited. The fact that SD seems to reduce physiological responses to imagined stressful stimuli does not necessarily imply that the presentation of the real feared stimulus will be accompanied by a similar decrease in autonomic arousal.

Dual process theory would certainly predict such a decrease. Research has shown that SD is accompanied by a reduction in autonomic arousal to stressful imagery and that SD had produced significant behavior change in a variety of phobias. If one assumes the validity of the dual process theory, as many researchers appear to do, then the generalization of such a reduction to the actual phobic stimulus

logically follows. However, as cited earlier, evidence exists which seriously questions the validity of the dual process theory. Therefore, the generalization of autonomic decrements from imaginal to real stimuli must not be assumed simply because it is predicted, but rather it must be established empirically.

The extension of physiological studies of SD into this area is thus necessary for a more thorough empirical test of Wolpe's formulation. According to Wolpe, there is no basis for the extinction of the avoidance response unless the subject is no longer autonomically aroused in the presence of the phobic object. Suggestive data on this problem have been presented by Carlson (1968), who took physiological measures immediately preceding an approach test in snake phobic subjects who had been treated by SD, modeling, and a cognitive approach. Results showed an increase in autonomic arousal in the period preceding the approach test, a result contradictory to the Wolpian position. Such data, however, must remain highly tentative with respect to SD since Ss treated by other techniques were included in the sample. In addition, Paul (1966) attempted to get some preliminary data by taking measures of pulse rate and skin conductance of speech phobic subjects immediately prior to their giving a speech. The measures were taken both before and after treatment and indicated that compared with other groups, the desensitization group was the only one to show a significant decrease in autonomic arousal.

Barlow, Leitenberg, Agras, and Wincze (1969) tested the effects of desensitization on arousal to the actual phobic stimulus in a more direct fashion. They treated one group of snake phobic subjects by

desensitization while another group actually saw the snake, rather than imagining it, during treatment. Results indicated that while both groups showed a decrease in arousal as measured by GSR to phobic imagery, only the group which was actually exposed to the snake during treatment showed a significant decrease in GSR activity to an actual presentation of the snake at posttest.

The Present Study

The purpose of the present study is to extend the investigation of the psychophysiological aspects of SD. In particular, a more direct test of the assumption of the dual process theory as an underlying mechanism of SD will be attempted. One specific test of this assumption would be the analysis of the extent to which the autonomic decrement which accompanies scene presentations during treatment transfers to the actual object at the completion of treatment. Barlow et. al. (1969) have certainly offered data directly relevant to this point, but unfortunately the only measure of autonomic arousal used was skin conductance and they did not include a no treatment control group. Nonetheless, their basic design is suitable for a direct test of the hypothesis.

As mentioned previously, the design of Barlow et. al. included the use of a group of subjects who actually saw the phobic object rather than imagining it during treatment. A similar design will be employed in the present study. The use of such an in vivo group is not unique (see Cooke, 1966; Garfield, Darwin, Singer, and McBreaty, 1967; and Ritter, 1968), and it makes possible certain important comparisons. In a treatment which involves the direct contact with a phobic object, the

problem of transfer from imaginal to real stimuli disappears. One would expect that any physiological changes during treatment would be present during an assessment session involving the same real object. As a result, comparisons of behavioral, cognitive, and physiological responsiveness to phobic objects after treatment among a standard systematic desensitization group, an in vivo desensitization group, and a no-treatment control group could have considerable bearing on the issues raised in this discussion. It is the purpose of this study to collect the data necessary to make such comparisons.

CHAPTER II

METHOD

Subjects

Ninety-three female undergraduates who reported a fear of white rats completed the Rat Phobia Questionnaire (RPQ, see Appendix A). Those subjects who scored at least seven on a 9-point scale of anxiety on Questions 2 and 3 were then asked to participate in a pretreatment assessment session. Of the 60 Ss who were assessed, only the 34 Ss who were unable to touch the rat with their bare hand were selected for the study. Of these 34 Ss, 27 participated in the entire study.* Following assessment session, each S was randomly assigned to one of three groups: Systematic desensitization (SD), in vivo desensitization (IV), or No treatment control (NT). For the final analysis, there were ten Ss in SD, eight in IV, and nine in NT.

Assessment Sessions

All Ss participated in at least two assessment sessions. The first session (pretest) occurred prior to treatment. Each S in a treatment group received her second assessment session (posttest) approximately one week following the completion of treatment. Four of the NT

*The reasons for subject attrition are as follows: three dropped voluntarily, one became ill, two were bitten during treatment, and the data for one S were not scorable due to equipment problems.

Ss were paired with four IV Ss and received posttesting during the same week as their paired IV Ss. The posttest time for the five remaining NT Ss was dependent upon the posttest week for their five paired SD Ss. Pairing was done on a random basis. Ss in SD and IV received a third assessment session (follow-up) which occurred approximately six weeks after posttest. During these assessment sessions, measures of S's motor, cognitive, and physiological responses to white rats were collected. The procedure for each of these measures is described below.

Motor Response

Subject's motor response to the rat was measured by the Active Approach Test (AAT). To introduce the AAT, the following instructions were read to each S:

> In a few minutes an assistant will enter the room and remove the electrodes. You will then be asked to approach the rat you saw earlier as closely as you can. The success of this experiment depends upon the accuracy with which we are able to measure your fear of rats. Therefore, you should try your very hardest to approach the rat as closely as you can. The rat has been handled frequently and is harmless, but if you feel you have reached a point where you cannot continue, simply let us know and the test will be terminated. Just try to relax for the next few minutes while we prepare for this test.

Two minutes after these instructions ended, S was asked to proceed with the task. She was given a checklist of 16 graded approach tasks (see Appendix B). The first task began with S standing by the door leading into the room which contained the rat. The cage and rat were placed on a table directly behind the door and ten feet from it. The floor was marked off at 6, 3½, and 1½ foot intervals. When S had gone as far as she would, she was asked to return to the original room. The last item

on the list which S had successfully completed was checked and served as her score for the AAT.

Cognitive Measures

Several measures of Ss' cognitive or subjective estimates of fear were collected. These are discussed separately.

(1) Active Approach Test Rating: Following the completion of the AAT, each S was asked to rate how anxious she felt while engaged in the last task she completed. This rating and all other anxiety ratings were done on a 9-point scale ranging from "No anxiety at all" to "Extreme anxiety".

(2) Scene Ratings: The procedure used for scene presentations was adopted from Lang, Melamed, and Hart (1970). It consisted of the presentation by tape player of neutral and presumably anxiety arousing imaginal stimuli (scenes). The following instructions were given to S at the beginning of this section:

> We are now ready to begin. During the first part of this procedure, you will be asked to visualize or imagine various scenes and situations. It is important that you make these scenes as realistic as you can and that you try to imagine yourself actually being in the situation. Imagine the scene with as much detail as possible. It is often helpful to close your eyes when you do this. In addition to asking you to imagine these scenes, I will ask you to rate certain aspects of the scenes. The first aspect is the vividness of the scene. When I ask you to stop visualizing a scene, I want you to forget the scene, open your eyes, and look at the left hand chart labelled Vividness above the mirror. You will notice there are four statements, numbered one through four. Each number represents a given level of Vividness. One is no image at all. Two represents a vague image. Three means a clear image and four means a very clear image. You are to decide which number best represents the vividness with which you visualized the last scene. You will be given ample time to decide, but do not deliberate. It is usually best to stick with your first impression. After a few moments I will say Vividness Rating. I will then count slowly from one to four. When I say the

number you have selected, you are to press the button by your right hand. This will let me know the number you have selected. Since this is a recording, I will sometimes keep counting after you have pressed the button. Simply disregard these numbers. Following the vividness rating, we will do an anxiety rating. Look at the chart labelled anxiety to the right of the vividness chart. I have already discussed this chart, but let me review it. This chart has the numbers one to nine listed on it, but only the numbers one and nine have a statement beside them. These statements let you know which end of the 9-point scale means high anxiety, and which end means low anxiety. As you can see, number one means no anxiety or complete relaxation. Number nine refers to the most extreme state of anxiety you can think of. The rest of the numbers represent various levels of anxiety or fear that fall between these extremes. For example, number five represents a level of anxiety which is half way between the two extremes. Your task is to select the number on the chart which best represents the level of fear or anxiety you experienced while imagining the last scene. Again you will be given time to select. Then I will say "Anxiety Rating" and count slowly from one to nine. When I reach the number you have selected, push the button. Let's try the first scene. Remember to imagine it as clearly as possible. Here it is:

Imagine yourself walking down a path here at the University. It is a pleasant spring day and you have nothing much on your mind. Try to imagine this as clearly as you can until I say stop. (ten seconds) Stop. Switch the scene off and look at the chart above the mirror labelled Vividness. Select the number which best represents how clearly you were able to imagine that scene. (ten seconds) Remember to press the button when I say the number that corresponds with your rating. Ready, Vividness Rating. 1 ... 2 ... 3 ... 4 ... Now make your selection for the anxiety rating. Choose the number that best represents the level of anxiety you experienced while imagining the last scene. (twelve seconds) Remember to press the button when I say the number that corresponds with your rating. Anxiety Rating. 1 ... 2 ... 3 ... 4 ... 5 ... 6 ... 7 ... 8 ... 9 ... Fine. Now just relax for a few moments before the next scene. (30 second pause--next scene presented)

There were four neutral and three phobic scenes (see Appendix C). The order of the neutral scenes was the same for all Ss, while the order of the phobic scenes was randomized for all Ss. The first scene was always a neutral scene, the next, a phobic scene. The presentation alternated from neutral to phobic until all seven scenes were presented.

(3) Passive Approach Test (PAT) Rating: This measure consisted of S's anxiety rating immediately after observing a white rat. At the beginning of the PAT, the following instructions were given to S:

> We are now ready to begin. In a few minutes you will be asked to look directly in front of you at the mirror. When the lights go on in the adjacent room, you will see a live white rat in a glass cage. After a while, the rat will leave the cage and approach the mirror. Please try to watch the rat as long as you can. If, however, you become so frightened you can no longer watch, press the button by your right hand. This will immediately eliminate your view of the rat. It is important that you watch the rat as long as you can. After you see the rat I will ask you to rate how anxious you felt.
>
> Remember to select the number which best represents how anxious you felt while observing the rat. I will then count slowly from one to nine. Press the button when I reach the number you have selected. Before we begin though, just sit quietly and relax.

After an anticipation period of 90 seconds elapsed, S was told to look directly in front of her, at a 2-way mirror. The lights in the S's room were dimmed while the lights in an adjacent room were intensified. In the adjacent room, directly in front of S but eight feet from the mirror, a white rat was visible in a plexiglass cage with a lid and gate. The rat remained in the cage for 60 seconds, at which time the gate was automatically opened and the rat ran down a plank to the mirror. The end of the plank was flush with the mirror and food pellets were placed there, so that the rat would eat at the end of the plank. After 30 seconds, the lights in S's room were brightened while those in the adjacent room were dimmed, so that S could no longer observe the rat. As a safeguard against overarousing a S, all Ss were informed that they could terminate their view of the rat at any time by pushing the signal button by her right hand.

Following the termination of S's view of the rat as a result of

either elapsed time or S's signal, S was asked to rate how anxious she felt while watching the rat. This rating was done on the same 9-point scale used for scene ratings.

(4) Rat Phobia Questionnaire (RPQ): This measure was briefly discussed in the subject section. It yielded a general rating of S's fear of rats. It was used as both a screening device and measure of S's subject fear.

Physiological Measures

During the assessment sessions, measures of Ss heartrate (HR) and skin conductance (SC) were continuously recorded. The periods of interest were as follows:

(1) Scenes--HR and SC response to the imagination of neutral and phobic scenes were recorded.

(2) PAT: Measures of HR and SC were recorded for the 2-minute period prior to the PAT (Ante PAT) and for the PAT itself.

(3) Anticipation of AAT (Ante AAT)--during the two minutes following the instructions for the AAT, S's HR and SC were monitored.

Apparatus

Physiological recordings were done on a Grass Model 5 polygraph and a Fels Model 22-A Dermohmmeter. HR was measured by attaching a Grass Model PTTN photoelectric transducer to S's left middle finger. The transducer was connected to the Grass Model 5P5-EEG preamplifier. SC was measured by the Fels Dermohmmeter. The electrodes (Model 22-30) and electrode jelly used were supplied by the Yellowsprings Instrument Company for use with the Fels. Electrodes were filled with jelly and

placed on S's left hand, such that the active electrode made contact with the palm, while the other made contact with the back of the hand.

Procedure

During assessment sessions, the order in which tasks were administered was as follows: RPQ, PAT, scene presentation, and the AAT. For each session, S was seated in a reclining chair by one of two female research assistants. The assistant then placed a pair of earphones on S's head and all further communications with S were done by tape player via the earphones. The only contact E had with Ss was during the AAT. Each S was given the following initial instructions:

> During the next hour you will be asked to participate in some tasks. The purpose of these tasks is to give us more information about your fear of rats. It is important that you listen carefully to all instructions and try to carry them out as best you can. Before each task you will be given specific instructions, but before we begin I want to draw your attention to the two charts above the mirror. During the tasks I will ask you to make use of one or both of these charts. As you can see, the one on the left is labelled Vividness and you will be given further instructions on how to use this chart. The chart on the right is labelled Anxiety and refers to the various levels of anxiety or fear. You are to think of the number one as referring to the complete absence of anxiety, while the number nine refers to total or maximum anxiety. The numbers two through eight refer to the various levels of anxiety between these two extremes. When I ask you to rate the level of anxiety you experienced during a task, you are to select the most appropriate number for the level you felt. I will then count slowly from one to nine. When I reach the number you have selected, press the button by your right hand. This will let me know your selection. Before going ahead with any of the tasks, I just want you to relax and sit quietly. I will let you know when we are ready to start.

After these instructions, S was given a 10-minute period of quiet in order to allow S to adapt to the physiological equipment and to establish a baseline of physiological responding.

Posttest and Follow-up

The assessment session as described above was repeated twice for each S. The posttest occurred a week after treatment was completed, while the follow-up assessment occurred approximately two months after the posttest.

The procedure used during posttest and follow-up was basically the same as that used during pretest with the following two exceptions. First, the RPQ was administered prior to the adaptation period. Second, the rats used during the AAT were injected with nembutal at the same dosage used in the in vivo treatment procedure.*

Treatment

(1) Semi-automated Desensitization (SD): The ten Ss in this group received a form of systematic desensitization. The procedure consisted of relaxation training and the presentation of hierarchy items by two tape players. Treatment sessions occurred in the same room as the assessment sessions. During all treatment sessions, S's pulserate and skin conductance levels were measured. As a result, each session began with the application of the plethysmograph and GSR electrodes by one of the assistants. Subject was then given a 10-minute adaptation period before the treatment procedure began.

The first treatment session consisted of an initial description of the treatment and abbreviated muscular relaxation training. The following instructions were played for S:

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*See description of in vivo treatment for an explanation of this procedure.

> Today we will begin the treatment program aimed at reducing your fear of rats. The treatment used is that known as Systematic Desensitization and consists of two major components, relaxation training and the pairing of that relaxation with your imagination of various scenes which involve white rats. This technique has been shown to be effective and there is every reason to believe it will be equally successful with you. Today's first session will be devoted to relaxation training, but before we begin, just sit quietly for a few minutes.

The relaxation training was very similar to that used by Paul (1966) except that the left hand exercises were eliminated since the electrodes were placed on that hand. With the exception of the left hand, then, each muscle group was tensed and relaxed twice. A transcription of the relaxation training tape can be found in Appendix D.

The session lasted approximately 40 minutes. When the tape ended, RA entered the room and removed the electrodes. She then gave S a list of the muscle groups used in the training and asked S to practice tensing and relaxing these muscles at least once a day.

Scene presentation began during the second treatment session. This session and all subsequent sessions began with a brief introduction to the session and relaxation suggestions. Following these suggestions, the first scene of the hierarchy was presented. The 16-item hierarchy used in SD was based on the Behavioral Checklist used in the AAT. Both the hierarchy and checklist were adapted from the 20-item standardized hierarchy developed by Nawas (1971). See Appendix E for a copy of the hierarchy.

Each S was instructed at the beginning of each SD session that if at any time during the imagination of a scene she felt anxiety, she was to press the button by her right hand. The scenes and relaxation

instructions were presented by two tape players which fed into the headphones given to S at the beginning of each session.

Each scene was presented either for 15 seconds or until S pressed the button, whichever occurred first. Imagination was terminated in either case by instructions to stop imagining the scene and relax. Thirty seconds of relaxation suggestions followed. The same scene or a new scene was then presented, depending upon whether S reported anxiety or reached criterion for that scene. Criterion for completion of a scene was two successive trials with no report of anxiety. If S reported anxiety on the first presentation of the next scene, the previous scene would then be presented until criterion was reached. If S reported anxiety on the second presentation of a scene after not reporting anxiety on the first presentation of that scene, the scene would continue to be presented until either S reported anxiety or did not report anxiety two times in a row. In the former case, the previous scene was presented again; in the latter, the next scene was presented. This procedure was continued until S completed all 16 scenes successfully. The only exception was the application of a special procedure for Ss who could not successfully complete a scene. In cases where a S could not complete a scene after 15 successive presentations, the next scene was presented five times regardless of S's report of anxiety. Each subsequent scene was similarly presented until all the scenes were completed. This special procedure was employed with two of the ten SD Ss. One S was unable to successfully complete the 13th scene, while the other S could not complete the 3rd scene.

Each session lasted approximately 45 minutes. Scenes were presented for 30 minutes, and each session ended with two successful presentations of a scene, except in those cases where the special procedure was employed. After the last presentation of a scene for the day, RA entered S's room, removed the electrodes and scheduled S for her next session. Treatment continued at the rate of one session per week until all the scenes had been presented.

(2) In vivo Desensitization (IV): Eight Ss were assigned to this group. The treatment was the same as that used for the SD group with the exception that rather than imagining the 16 items on the hierarchy, the Ss were asked to actually perform them.

The first session consisted of relaxation training. This was done in the same way as in the SD group. Initial instructions were modified to account for the difference in the treatment procedure. Ss in this group were given the following initial instructions:

> Today we will begin the treatment program aimed at reducing your fear of rats. The treatment used will be a variant of Systematic Desensitization and consists of two major components, relaxation training and the use of that relaxation while performing certain tasks in relation to a white rat. This technique has been shown to be effective and there is every reason to believe it will be equally successful with you. Today's first session will be devoted to relaxation training, but before we begin, just sit quietly for a few minutes.

For the remaining treatment sessions, S was seated by RA in the experimental room in such a way that she could not see the door which led into the adjacent room. She was given a button which was at the end of a long cord and told to use this button to signal anxiety. RA then left the room. All further instructions were given via loudspeakers in both the experimental and adjacent rooms. For all IV

sessions, the rooms were arranged in the same manner as for the AAT.

At the beginning of treatment for all IV Ss, one rat was used. During the course of treatment, however, this rat bit a S. Another rat was chosen, and this rat also bit a S. Since any S who had been bitten had to be dropped from the study, a technique had to be used to minimize the possibility of losing another S because of a bite. Therefore, for all subsequent sessions, rats were injected with nembutal at a dosage of ten mg/kg body weight. This light dosage was selected since it appeared to have minimal effect on the rat's behavior other than to reduce its aggressiveness. Three Ss had completed the treatment prior to this change in procedure. The remaining Ss completed the treatment with drug-treated rats. These rats weighed from 460 to 500 grams with a mean of 478 g and a standard deviation of 17.3 g.

During IV treatment, Ss were asked to proceed through 16 graded tasks which were matched to the 16 scenes in the SD hierarchy. Progress through the hierarchy was dependent upon the same criteria used for progress in SD. Only one of the IV Ss failed to complete hierarchy, and since it was impossible to "force" her through the remaining tasks (in this case, S could not complete the last task), treatment was terminated after nine sessions.

(3) No Treatment Group (NT): Ss in this group received no treatment between pre- and posttest. Following pretest, they were told that there was no time to treat them for a few months but that they would eventually receive treatment. They were asked if they would be willing to participate in the assessment session once more before that treatment session began. Of the 11 Ss originally assigned to this

group, one refused to return for posttest and the data for one S were eliminated because of equipment failure. As a result, nine Ss were left in the group.

After posttest, all NT Ss were treated with either the IV or SD procedure. They then participated in a final assessment session.

CHAPTER III

RESULTS*

Pretest Differences

Although Ss were randomly assigned to each of the three groups, analyses of variance were performed on the pretest data alone in order to insure that no initial differences existed. None of these analyses reached significance, indicating that the groups were matched.

Treatment Factors

Before commencing with the report of actual posttest data, it is necessary to compare the treatment groups on a number of variables. An attempt was made in the procedure to make the treatments for the SD and IV as similar as possible except for the imaginal-real distinction in stimulus presentation. Table 1 presents the means for several treatment variables. As indicated in the table, there was a significant difference for the mean number of scene vs. task presentations per session. The number of presentations per session was higher for the SD group than for the IV group. This is to be expected since the presentation of scene in SD took less time than the performance of a task

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*Data analyses reported were performed on all Ss in the SD group, including those who did not complete the hierarchy using the standard procedure. Exclusion of the data from these Ss did not affect any statistical conclusions.

TABLE 1

Treatment Variables

Variable	Group SD	Group IV	t	df
Mean Number of Sessions	3.2	4.6	-1.54	16
Mean Number of Presentations	91.8	84.2	0.32	16
Mean Number of Presentations Per Session	27.6	19.3	3.34*	16
Mean Number of Presentations Per Scene	5.7	5.3	0.32	16
Mean Number of Anxiety Reports	24.2	15.0	0.87	16
Mean Number of Anxiety Reports Per Session	1.5	0.94	0.87	16

*$p < .01$

in the IV procedure. There were no significant differences for the number of sessions, the total number of presentations, the average number of presentations per task, the number of anxiety reports per session, or the total number of anxiety reports. Of those Ss who completed treatment, two SD Ss failed to complete the hierarchy using the standard procedure, and one IV S failed to successfully complete the last task in the hierarchy.

Treatment Effects

Behavioral Measure: Changes in Ss motor behavior with respect to the rat were measured by the AAT. Scores on this measure range from a minimum of 1, which indicates that a S refused to open the door leading into the testing room, to a maximum of 16, which indicates that a S was able to hold the rat. Table 2 lists the mean AAT scores for each group at pre- and posttests. Figure 1 presents the means graphically. Since the assumption of homogeneity of variance was violated on the posttest AAT scores, a Kruskal-Wallis 1-way analysis of variance was performed. This analysis yielded a significant group effect ($H = 10.39$, $df = 2$, $p < .02$). Posttest comparisons between groups were accomplished by the application of Mann-Whitney U tests. These revealed that both IV and SD were significantly higher on the AAT than was NT ($U = 9.5$, $p < .02$ and $U = 15.0$, $p < .02$ respectively). Finally, Wilcoxon T tests were applied to pre- and posttest scores within each group to test for significant changes. These revealed that both SD and IV changed significantly ($T = 0$, $n = 10$, $p < .01$ and $T = 0$, $n = 8$, $p < .01$ respectively). There was no significant change for the NT group.

TABLE 2

Pre- vs. Posttest Mean Scores and t Values for AAT, AAT Rating, PAT Rating, Scene Ratings, and RPQ

	Group								
	SD			IV			NT		
Measure	Pre	Post	df=9 t	Pre	Post	df=7 t	Pre	Post	df=8 t
AAT	7.2	11.7	N/A	7.2	14.1	N/A	8.0	8.6	N/A
AAT Ratings	7.3	5.4	2.69*	6.7	2.6	5.4***	6.4	5.9	.67
PAT Ratings	6.2	4.0	3.40**	6.4	2.2	9.3***	6.0	6.0	0.00
Neutral Scenes									
Anxiety	1.2	1.1	1.03	1.4	1.1	1.4	1.1	1.0	.63
Vividness	3.5	3.4	.88	3.5	3.6	-0.3	3.4	3.5	-1.15
Phobic Scenes									
Anxiety	5.8	3.6	5.15***	5.9	2.6	6.6***	5.1	4.2	2.00
Vividness	3.5	3.5	0.00	3.5	3.8	-1.54	3.3	3.5	-1.90
RPQ	6.7	4.7	4.00**	6.7	2.4	9.49***	6.0	6.4	-1.90

*$p < .05$
**$p < .01$
***$p < .001$

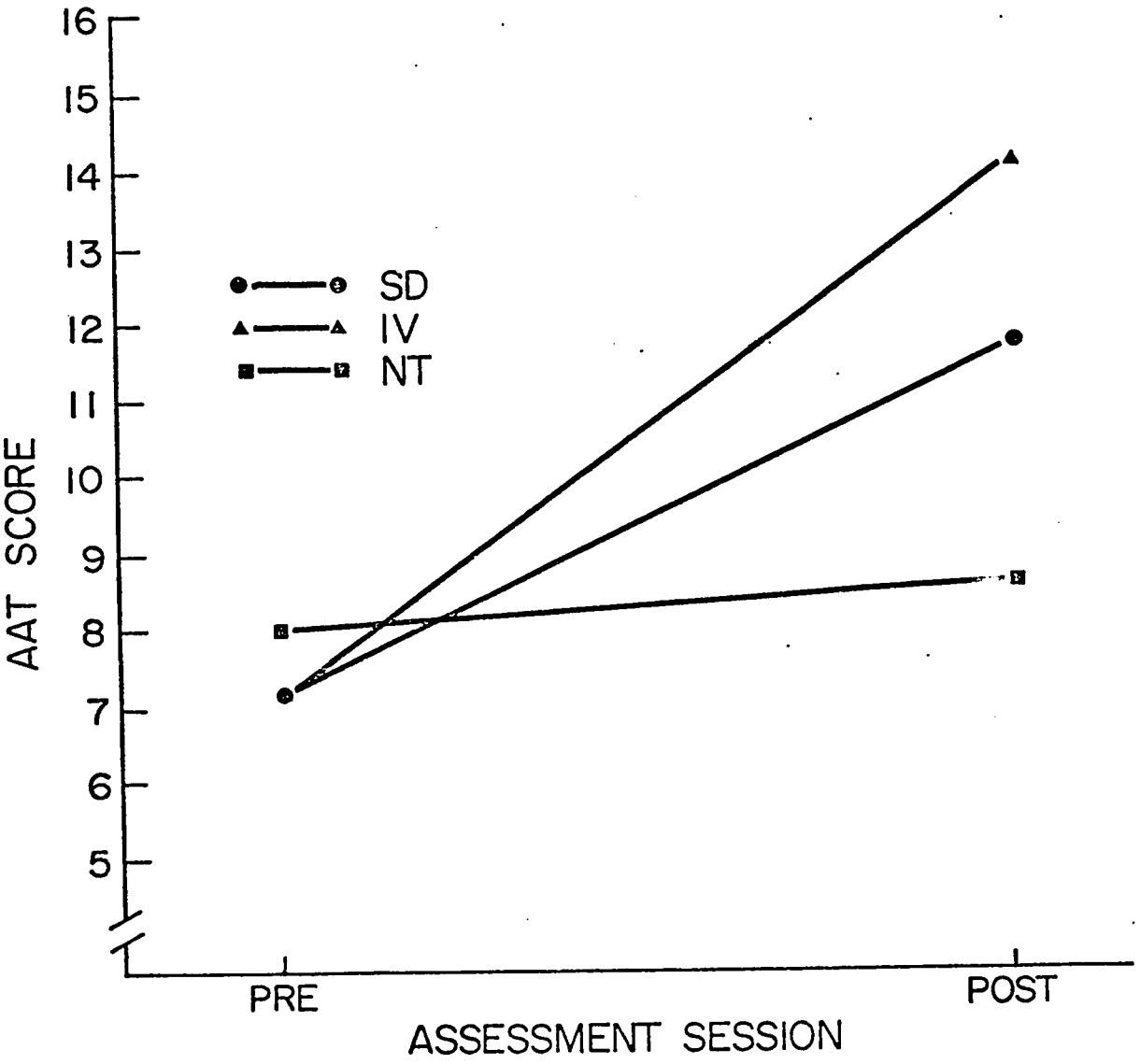

FIGURE 1

Mean Pre- and Posttest AAT Scores

Subjective Measures: Four subjective measures of fear were taken. These included the AAT Rating, PAT rating, scene ratings, and RPQ.

The analysis of variance on the AAT ratings are summarized in Table 3. This analysis yielded significant main effects for time and groups, and an interaction between these factors. Figure 2 graphs this interaction. The interaction is most likely due to the greater amount of change in the IV group over time. A Newman-Keuls analysis of post-test scores yielded significant differences between IV and NT and IV and SD ($q(3, 24) = 4.23$, $p < .05$ and $q(2, 24) = 3.33$, $p < .05$ respectively). An analysis of change scores indicated that both the IV and SD groups changed significantly, but the NT did not (see Table 2). The change in the SD group must be interpreted cautiously, however, since its pretest mean rating was higher than that for the NT group. Nonetheless, its posttest mean rating was below that for NT.

The analysis of the PAT ratings yielded results similar to that of the AAT ratings, as shown in Table 4. There was a significant main effect for time and a significant interaction between time and groups. The main effect for group did not reach significance. Figure 3 depicts the interaction. Amount of change from pre- to posttest was analyzed by t-tests for related groups. While there was no change in the NT group, both the SD and IV groups changed significantly (see Table 2). Newman-Keuls posttest comparisons, however, yielded a significant difference between IV and NT only ($q(3, 24) = 4.69$, $p < .05$).

A summary of the analysis of variance for the RPQ can be found in Table 5. Again, there were significant time and group main effects,

TABLE 3

Anova Summary Table--AAT Ratings

Source	df	MS	F
Time (A)	1	60.1667	27.086***
A x B	2	17.5111	7.883**
A x Subject	24	2.2213	-
Group (B)	2	19.6296	4.322*
Subject	24	4.5417	-

*$p < .05$

**$p < .01$

***$p < .001$

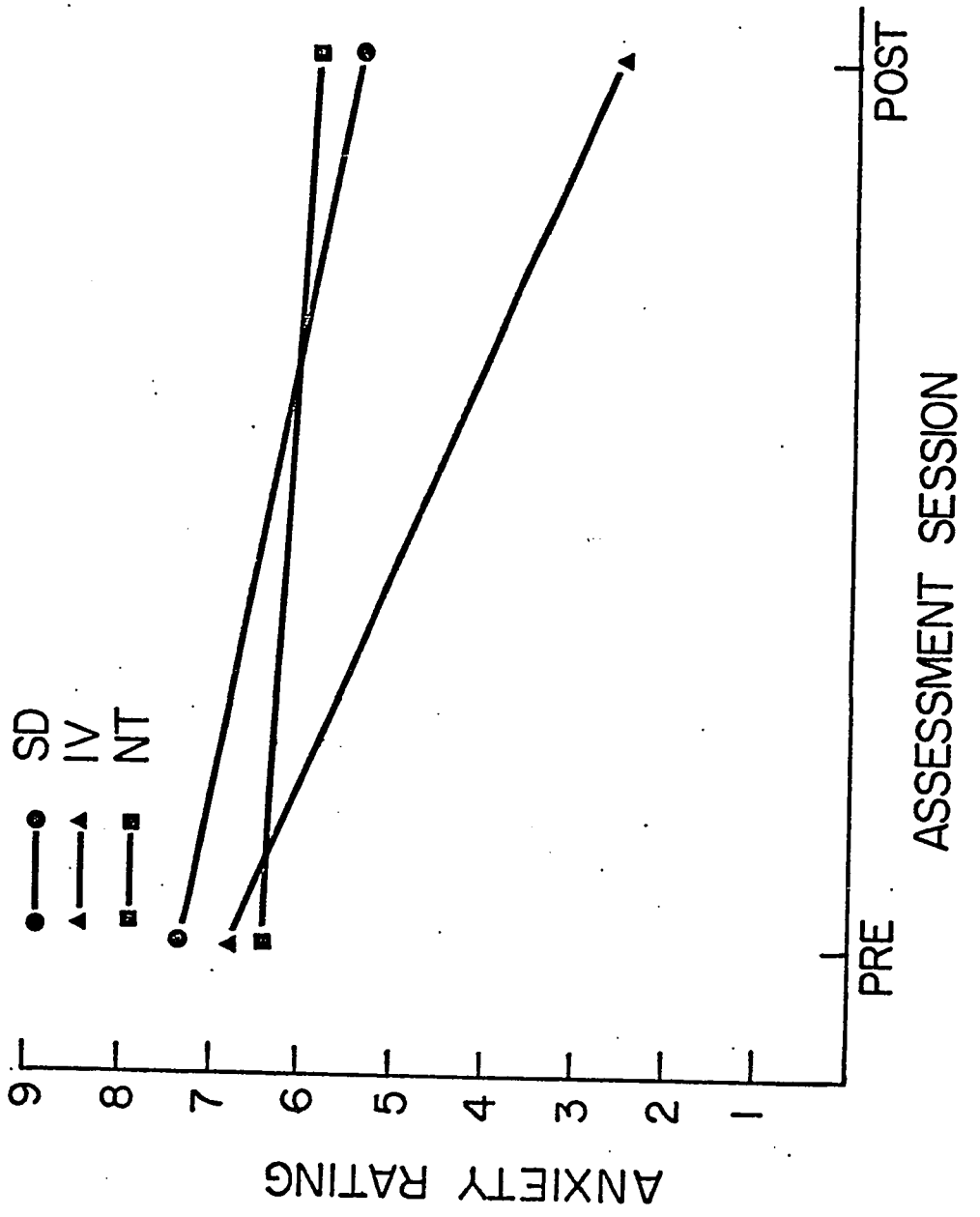

FIGURE 2

Mean Pre- and Posttest Anxiety Ratings for the AAT

TABLE 4

Anova Summary Table--PAT Ratings

Source	df	MS	F
Time (A)	1	56.0185	37.411***
A x B	2	20.2720	13.538**
A x Subject	24	1.4974	-
Group (B)	2	13.9312	1.954
Subject	24	7.1307	-

** $p < .01$

*** $p < .001$

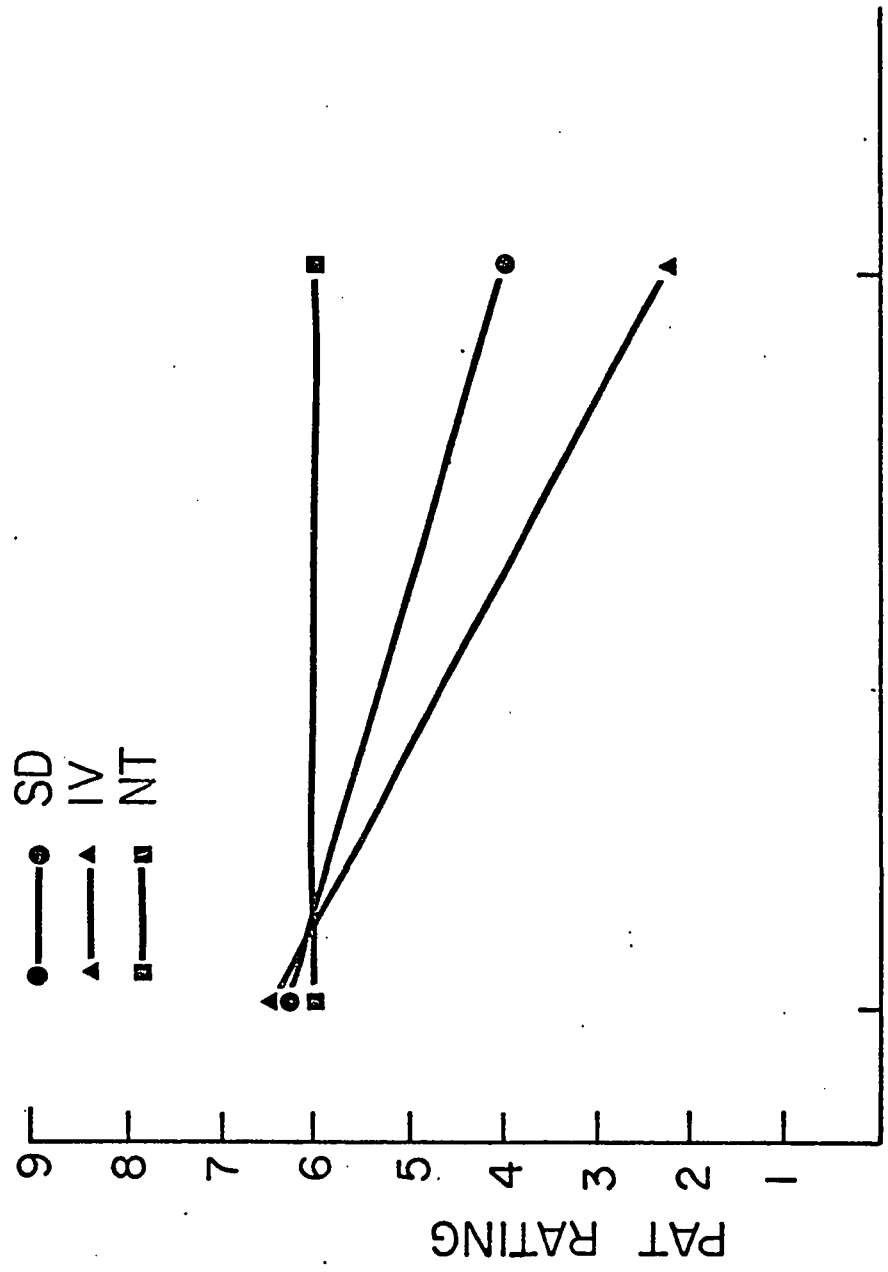

FIGURE 3

Mean Pre- and Posttest Anxiety Ratings for the PAT

TABLE 5

Anova Summary Table--RPQ

Source	df	MS	F
Time (A)	1	47.23	59.98**
A x B	2	23.56	29.92**
A x Subject	24	0.79	-
Group (B)	2	11.99	4.14*
Subject	24	2.90	-

*$p < .05$

**$p < .001$

as well as an interaction between the two, which is graphed in Figure 4. Newman-Keuls comparisons yielded significant differences between SD and NT ($q(2, 24) = 2.96$, $p < .05$), between IV and NT ($q(3, 24) = 7.22$, $p < .01$), and between SD and IV ($q(2, 24) = 4.26$, $p < .05$). Analyses of change scores indicate that both SD and IV changed significantly, while NT did not (see Table 2).

The analyses of the anxiety ratings of the phobic scenes again yielded results similar to the above findings. As shown in the summary of analysis of variance (Table 6), there was a significant main effect for time and a significant interaction between time and groups. Figure 5 shows this interaction. Newman-Keuls posttest comparisons failed to yield any significant differences among the groups. Analyses of change scores indicate that only SD and IV changed significantly from pre- to posttest.

On the basis of the above findings, some general conclusions are evident regarding the data on subjective indicants of fear. First, it is clear that the IV group shows the greatest amount of fear reduction, showing significant differences at posttest from NT on all measures and from SD on two of the measures. Second, while the SD group consistently reported less fear than the NT group on all measures at posttest, it only differed significantly from NT at posttest on one measure, the RPQ. On the other hand, both SD and IV showed significant reductions in fear estimates on all subjective measures from pre- to posttest. NT showed a significant decrease on phobic imagery only, while it showed nonsignificant reductions on the AAT ratings and PAT ratings and a nonsignificant increase on the RPQ.

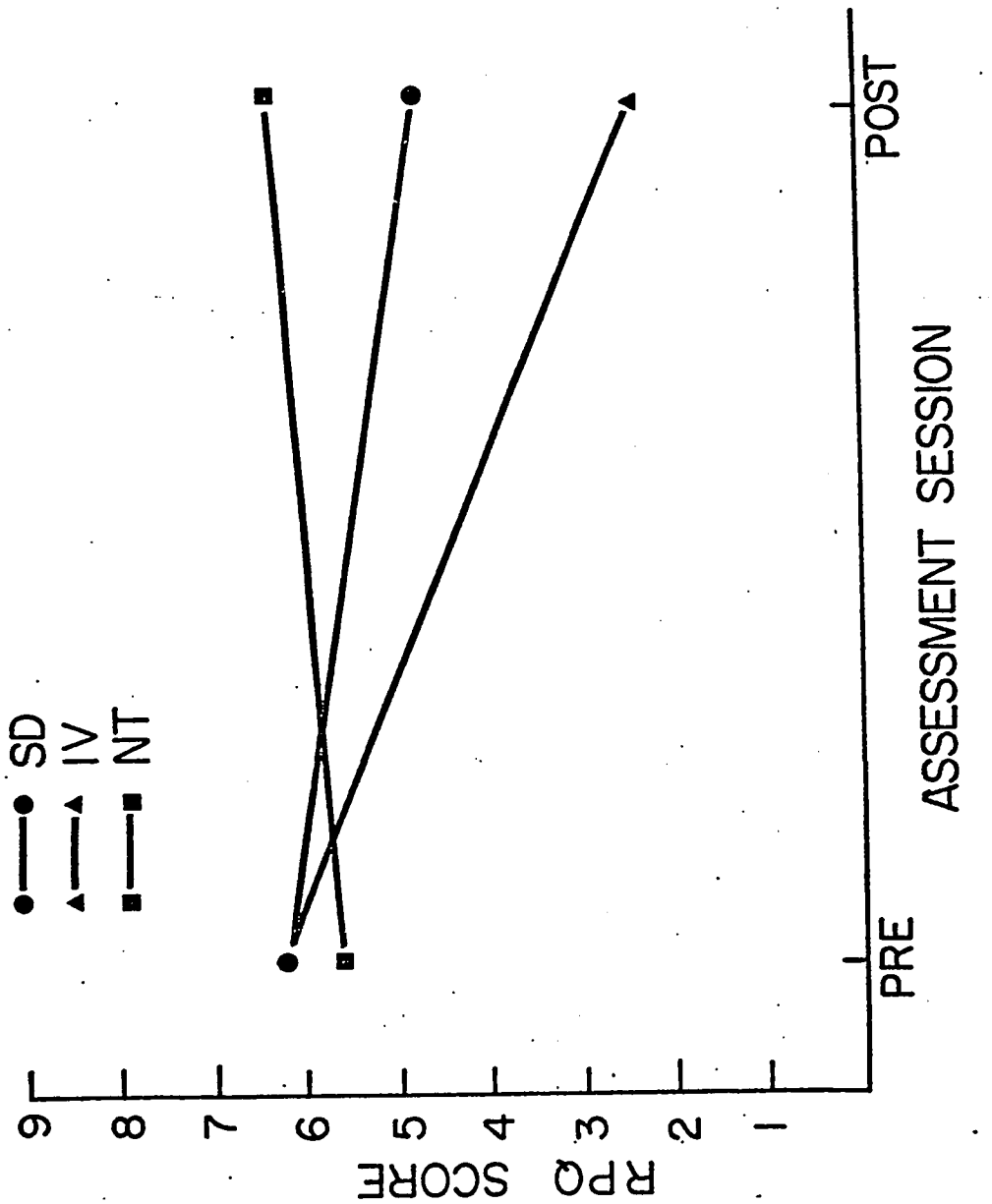

FIGURE 4

Mean Pre- and Posttest RPQ Scores

TABLE 6

Anova Summary Table for Anxiety Ratings of Phobic Scenes

Source	df	MS	F
Time (A)	1	174.2222	76.343**
A x B	2	23.8370	10.445**
A x Subject	24	2.2821	-
Group (B)	2	6.2247	< 1.000
Subject	24	14.6840	-
Scene (C)	2	102.8580	54.962***
B x C	4	0.9469	< 1.000
C x Subject	48	1.8714	-
A x C	2	3.3518	2.763
A x B x C	4	1.1000	< 1.000
A x C x Subject	48	1.2131	-

** $p < .01$

*** $p < .001$

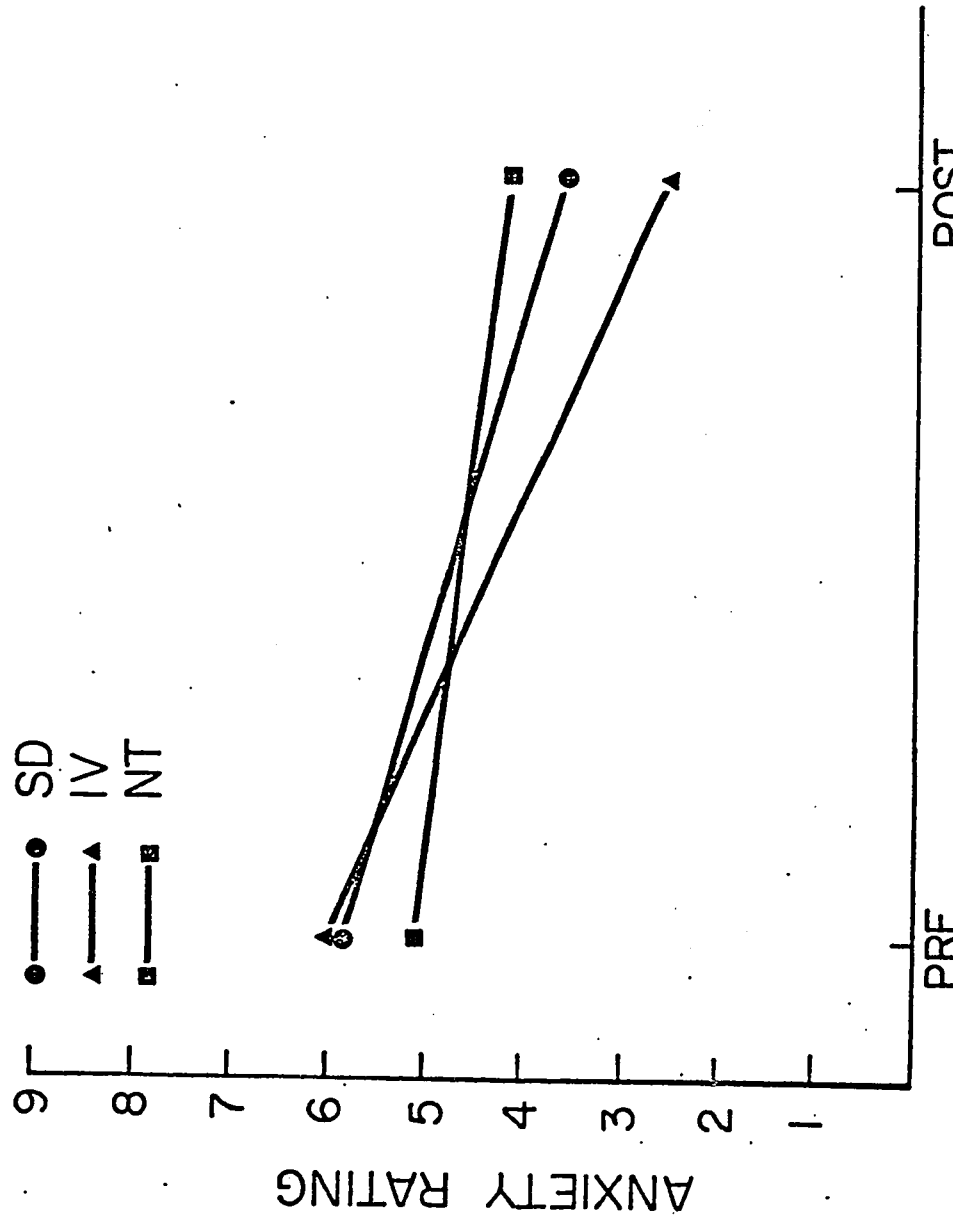

FIGURE 5

Mean Pre- and Posttest Anxiety Ratings of Phobic Scenes

Physiological Measures

Passive Approach Test: The PAT was divided into three periods--base, ante, and light. The base period consisted of the last minute of the 10-minute adaptation period. The ante period included the first 60 seconds of the time between the end of the instructions for the PAT and the onset of the light in the adjacent room. The light period consisted of the time between the onset of the light and the opening of the gate. Usually, this was a period of 60 seconds. If, however, S pushed the buzzer before the gate was opened, the time for this period would be less than 60 seconds. The period after the gate was opened was not analyzed since several Ss pushed the buzzer before a reasonable amount of time had passed.

For each of these periods, and all periods subsequently described, both heartrate (HR) and average skin Conductance (SC) were measured. Heartrate was measured as the number of beats occurring within the period. This number was then transformed into beats per minute (bpm). The scores for experimental periods were then calculated by taking a ratio of that period to the base period. For example, the HR measure for the ante period of the PAT was calculated by dividing the bpm for the ante PAT by bpm for the base PAT. Thus, a score of 1.00 would mean that the bpm for the experimental and the base periods were equal.

Skin conductance was measured as the average log micromhos of conductance for a period. Each period of the PAT was divided into 10-second intervals. In those cases where the light period was less than 60 seconds in duration, the end of the period was considered the

last point in a period. This measure was converted into a log of the conductance. These logs were then summed for the period and divided by the number of points for which a measure of conductance was taken.

The score for a particular period used in analyses was then calculated by subtracting the average log conductance for the appropriate base period from the average log conductance of the experimental period. As a result, a score of zero would indicate that average level of conductance was the same for both the base and experimental periods. A negative score would indicate higher conductance at base, while a positive score would indicate higher conductance during an experimental period.

A summary of the analyses of variance for the HR measure of the PAT can be found in Table 7. The analysis yielded a significant main effect for period and a significant interaction between groups and time. The period effect is due to the significantly greater HR ratio for the light period than for the ante period. The time X group interaction is illustrated in Figure 6. As the figure indicates, the HR ratio for NT increased from pre- to posttest, while the ratios for SD and IV decreased. It is important to note, however, that even though the ratio for SD decreased, HR was still greater during the PAT than for base period at posttest.

Newman-Keuls posttest comparisons between the groups are calculated for the ante period and light period separately. SD did not differ significantly from NT or IV during either period. IV, however, did differ significantly from NT during both of these periods ($q(3, 24) = 3.75$, $p < .05$ and $q(3, 24) = 3.71$, $p < .05$ respectively).

TABLE 7

Anova Summary Table--PAT--Heartrate

Source	df	MS	F
Time (A)	1	.0274	3.179
A x B	2	.0599	6.954**
A x Subject	24	.0086	-
Group (B)	2	.0129	1.134
Subject	24	.0114	-
Period (C)	1	.1213	26.569**
B x C	2	.0015	<1.000
C x Subject	24	.0046	-
A x C	1	.0078	2.495
A x B x C	2	.0096	3.058
A x C x Subject	24	.0031	-

**$p < .01$

***$p < .001$

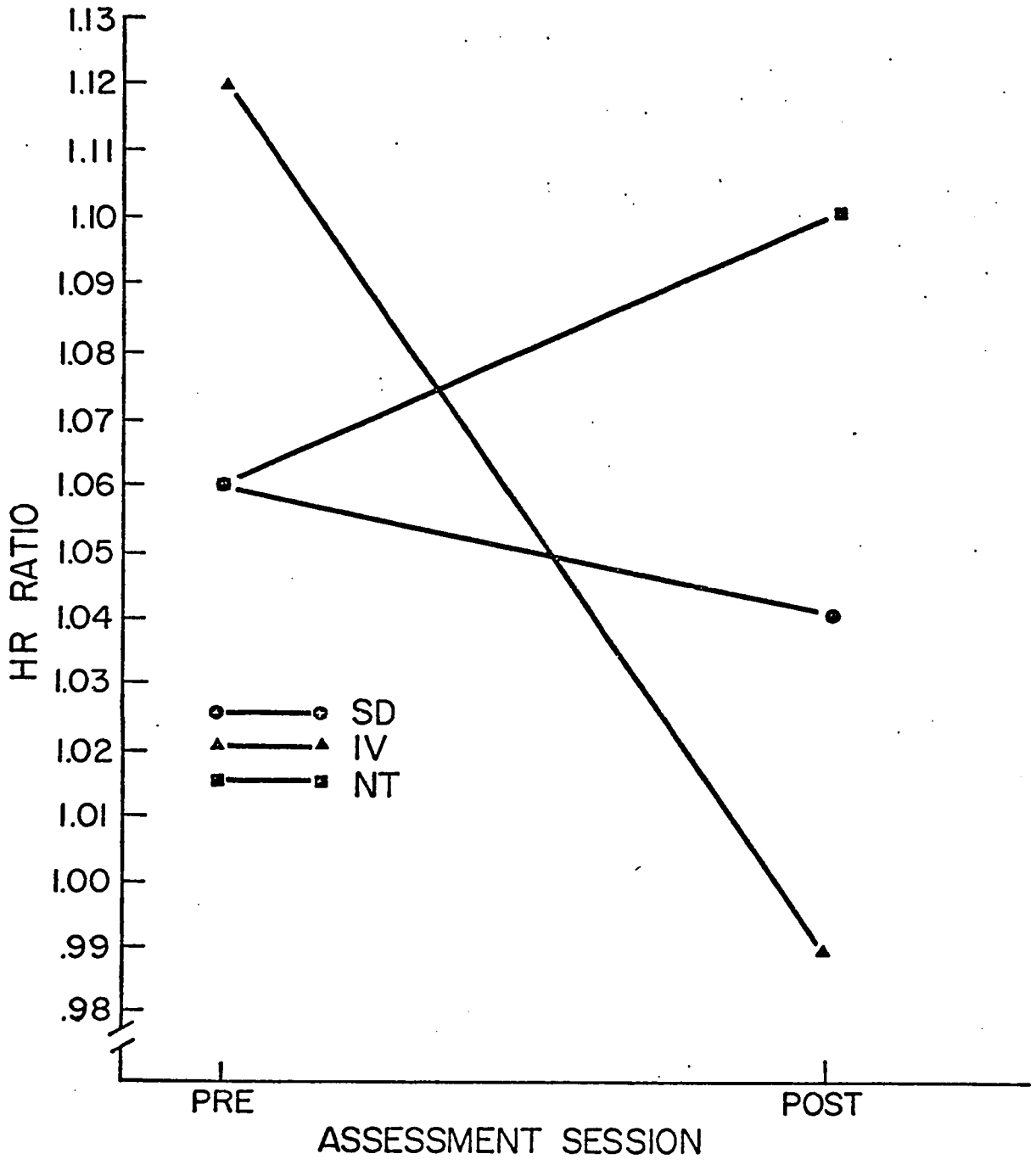

FIGURE 6

Mean Pre- and Posttest Heartrate Ratios for the PAT

Analyses of change scores for HR on the PAT are listed in Table 8. The SD group showed no significant changes from pre- to posttest. The IV group showed significant decreases in HR ratios for both the ante and light periods. The NT group showed no significant change during the ante period but showed a significant increase for the light period.

Results from the analysis of skin conductance for the PAT are very similar to those for HR. A summary of the analysis of variance on SC can be found in Table 9. This analysis yielded a significant main effect for period and a significant interaction between groups and time. Again, the period effect is due to the higher mean SC during the light than during the ante period. Figure 7 illustrates the interaction between groups and time. Posttest comparisons yielded significant differences for IV vs. NT for both the ante and light periods ($q(3, 24) = 3.7$, $p < .05$ and $q(3, 24) = 4.08$, $p < .05$ respectively). IV also showed significantly lower SC than SD at posttest for the light period ($q(2, 24) = 3.05$, $p < .05$) but not for the ante period. SD did not differ significantly from NT for either period. Analysis of change scores (Table 11) produced significant decreases in SC for IV only.

In summary, the physiological data for the PAT consistently shows that the IV group experienced a significant decrease in physiological arousal from pre- to posttest. In addition, the IV group's level of arousal as measured by HR and SC at posttest was significantly lower than NT for both the ante and light periods and significantly less than SD for the light period.

Scene Presentation: During the assessment sessions, Ss were

TABLE 8

Pre- vs. Posttest Mean Scores and t Values for PAT Heartrate and Skin Conductance Measures

	Group								
	SD			IV			NT		
Measure	Pre	Post	df=9 t	Pre	Post	df=7 t	Pre	Post	df=8 t
HR Ante	1.04	1.00	1.34	1.07	.96	3.58**	1.05	1.05	0.0
HR Light	1.07	1.08	-.42	1.17	1.02	2.32*	1.07	1.15	-2.35*
SC Ante	.0739	.0500	1.25	.0651	-.0027	2.88**	.0600	.0676	-.45
SC Light	.1206	.1063	.69	.0986	.0085	2.50**	.1029	.1391	-.83

*$p < .05$

**$p < .025$

***$p < .005$

TABLE 9

Anova Summary Table--PAT--Skin Conductance

Source	df	MS	F
Time (A)	1	.0145	2.497
A x B	2	.0217	3.738*
A x Subject	24	.0058	-
Group (B)	2	.0257	-
Subject	24	.0141	-
Period (C)	1	.0541	46.907***
B x C	2	.0029	2.533
C x Subject	24	.0011	-
A x C	1	.0003	< 1.000
A x B x C	2	.0013	1.270
A x C x Subject	24	.0011	

*$p < .05$

***$p < .001$

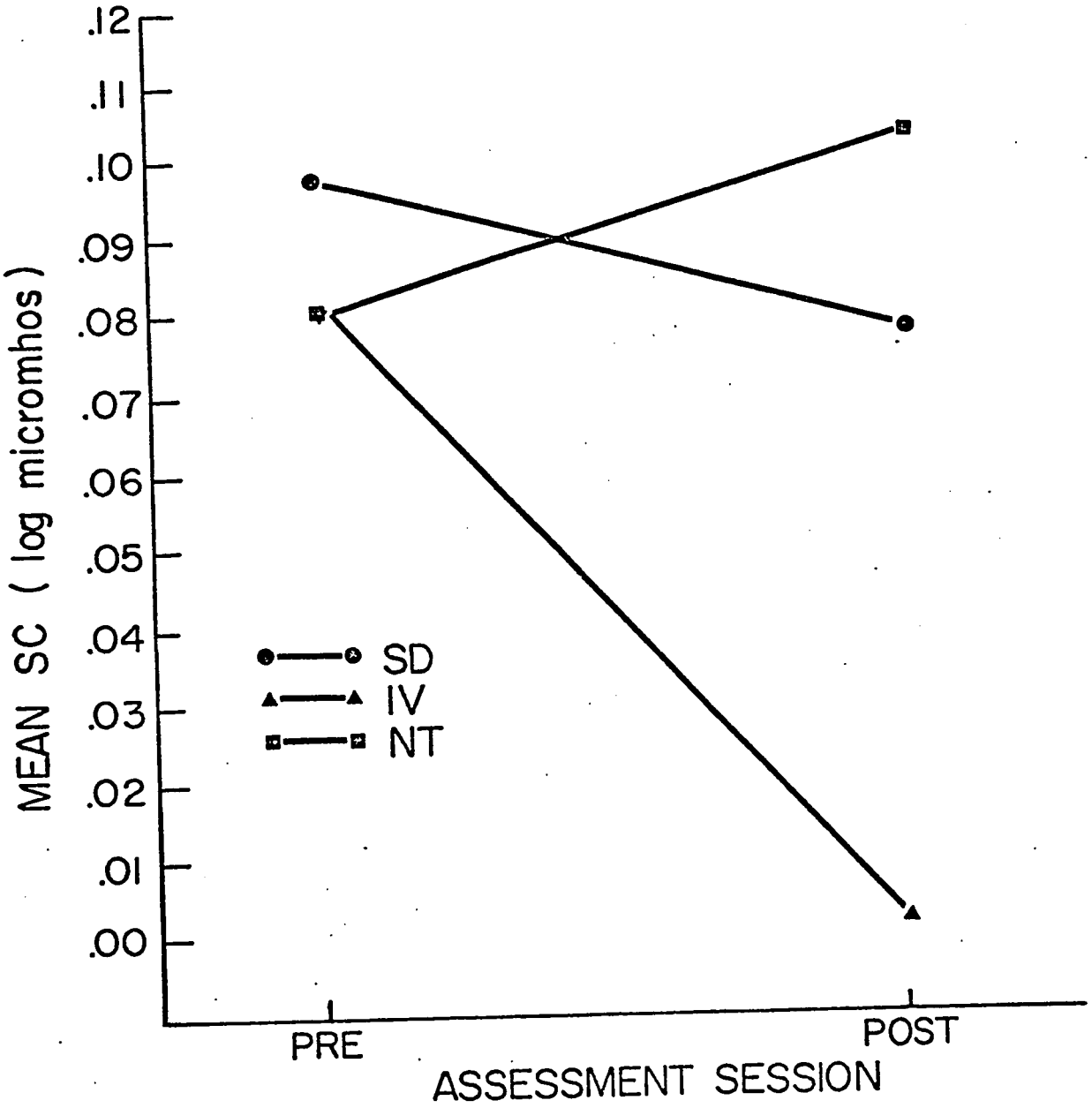

FIGURE 7

Mean Pre- and Posttest Skin Conductance Responses to the PAT

asked to imagine seven scenes--four of neutral content and three of phobic content. Both HR and SC were measured during the imagination of these scenes. In order to measure these indices, a base period and an image period were defined. The base period consisted of the ten seconds immediately prior to the reading of a scene. The image period consisted of the ten seconds immediately after the reading of a scene. The HR ratio was derived by dividing the number of beats during the image period by the number of beats during the base period. The points used for SC measurement were those at the beginning and end of each period. These two points were averaged for each period. The SC score for a particular scene was established by subtracting the average SC for the base period from the average SC for the image period.

The first important question to be answered regarding the physiological concomitants of imagery is whether the levels of HR and SC during phobic imagery are different from the levels during neutral imagery. One way of testing this hypothesis is to compare the pretest levels of arousal of all Ss in the study for imagery or neutral vs. phobic scenes. The mean HR ratio for the neutral scenes at pretest was 0.99, while the mean HR ratio for phobic scenes was 1.06. The difference between these means is significant ($t = -5.55$, $df = 26$, $p < .0005$, one tail). Similarly, the mean SC for neutral scenes at pretest was -.0014 compared to a mean of .0081 for phobic scenes ($t = -1.54$, $df = 26$, $p < .01$, one tail).

The next problem, given that there is a differential response to phobic imagery, is whether these responses were affected differentially by treatment. The summary of analysis of variance for the HR

response to phobic scenes is presented in Table 10. The summary for SC is shown in Table 11. Both of these analyses yielded significant main effects for time and for scenes, but not for groups or, more importantly, for an interaction between groups and time. All groups showed a decrease in HR and SC response to phobic imagery from pre- to posttest. Table 12 presents the pre- and post mean HR and SC responses for all the groups. As indicated in the table, SD showed significant reductions in HR and SC from pre- to posttest, while IV and NT showed significant reductions in SC only.

In general, the analysis of physiological response to phobic imagery fails to differentiate the groups. When the three groups are considered together, there is a significant reduction in arousal from pre- to posttest. While SD was the only group with a significant decrease in HR response, the other groups did show decreases on this measure, and all groups showed a significant reduction in SC. In addition, posttest comparisons among the groups failed to yield any significant differences among groups for either HR or SC.

Ante Active Approach Test: During the assessment session, HR and SC were measured during the period immediately prior to the AAT. This is a 2-minute period labelled Ante AAT. The base period for the Ante AAT was the minute of silence immediately preceding the instructions for the AAT. This period and each minute of the Ante AAT were divided into 10-second intervals for the purposes of determining average skin conductance.

In general, the results yielded by the analysis of HR and SC for the Ante AAT are not significant. Tables 13 and 14 list the

TABLE 10

Anova Summary Table--Phobic Scenes--Heartrate

Source	df	MS	F
Time (A)	1	.0601	5.652**
A x B	2	.0012	<1.000
A x Subject	24	.0106	-
Group (B)	2	.0081	<1.000
Subject	24	.0183	-
Scene (C)	2	.0341	5.874**
B x C	4	.0081	1.392
C x Subject	48	.0058	-
A x C	2	.0065	<1.000
A x B x C	4	.0049	<1.000
A x C x Subject	48	.0076	-

*p< .05

**p< .01

***p< .001

TABLE 11

Anova Summary Table--Phobic Scenes--Skin Conductance

Source	df	MS	F
Time (A)	1	.0798	17.301**
A x B	2	.0046	<1.000
A x Subject	24	.0045	-
Group (B)	2	.0042	<1.000
Subject	24	.0094	-
Scene (C)	2	.0173	9.122**
B x C	4	.0047	2.498
C x Subject	48	.0019	-
A x C	2	.0066	1.804
A x B x C	4	.0080	2.191
A x C x Subject	48	.0036	-

**$p < .01$

TABLE 12

Analysis of Change Scores for Heartrate and Skin Conductance on Phobic Imagery

	Heartrate				Skin Conductance			
Group	Pre	Post	t	df	Pre	Post	t	df
SD	1.07	1.04	1.93*	9	.0071	.0007	2.71**	9
IV	1.06	1.04	1.02	7	.0065	-.0111	1.89*	7
NT	1.05	1.01	1.38	8	.0105	-.0072	3.63***	8
MEAN	1.06	1.03	2.43***	26	.0081	-.0060	4.16+	26

*$p < .05$

**$p < .025$

***$p < .01$

+$p < .001$

TABLE 13

Anova Summary Table--Ante AAT--Heartrate

Source	df	MS	F
Time (A)	1	.0000	< 1.000
A x B	2	.0025	< 1.000
A x Subject	24	.0037	-
Group (B)	2	.0091	1.411
Subject	24	.0064	

TABLE 14

Anova Summary Table--Ante AAT--Skin Conductance

Source	df	MS	F
Time (A)	1	.0055	<1.000
A x B	2	.0056	<1.000
A x Subject	24	.0101	-
Group (B)	2	.0090	<1.000
Subject	24	.0126	-

summaries of the analyses of variance for HR and SC respectively. For both HR and SC there were no significant main effects for time or groups and there was no significant interaction between the two factors.

Sessions Analysis

An analysis of physiological responding during SD treatment was undertaken in order to determine whether or not there were any within treatment physiological changes occurring. In order to assess this factor, S's HR and SC were scored during the first presentation of a scene on which S signalled anxiety and on the last presentation of the scene. If S's responses to a scene were habituating, there should be a significant difference in HR and SC between the first and last presentation of such a scene.

Tables 15 and 16 present the results for this analysis on HR and SC respectively. Scenes were grouped into three levels, based on assumed levels of anxiety (low, moderate, and high). There was a significant effect for presentation on both HR and SC. In other words, there was a significant decrease in HR response and SC associated with the presentation of scene when anxiety was signalled as compared to the presentation of that scene when no anxiety was reported. Whether a scene was of a high, moderate, or low level of anxiety apparently made no difference with respect to eventual habituation.

Follow-up

Statistical comparisons were only possible between SD and IV. Table 17 presents these comparisons with their corresponding t values. Tables 18 and 19 present t test summaries for pretest to follow-up and

TABLE 15

Anova Summary Table--Grouped Scenes--Heartrate

Source	df	MS	F
Anxiety Report (A)	1	.2781	24.950***
A x B	2	.0046	<1.000
A x Subject	65	.0111	-
Scene Level (B)	2	.0054	<1.000
Subject	65	.0108	-

*** $p < .001$

TABLE 16

Anova Summary Table--Grouped Scenes--Skin Conductance

Source	df	MS	F
Anxiety Report (A)	1	.0248	34.445***
A x B	2	.0007	1.059
A x Subject	65	.0007	-
Scene Level (B)	2	.0001	2.331
Subject	65	.00005	-

*** $p < .001$

TABLE 17

Follow-up Comparisons of Mean Scores for SD and IV for 14 Dependent Measures

Measure	Group SD	Group IV	t	df	p
AAT	13.1	15.5	-3.16	16	$p < .01$*
AAT Rating	5.5	2.6	2.81	16	$p < .01$*
PAT Rating	3.3	2.25	1.17	16	n.s.
Neutral Scenes Anxiety PAT	1.1	1.1	0.00	16	n.s.
Phobic Scenes Anxiety Ratings	3.6	2.5	1.56	16	n.s.
RPQ	4.6	2.7	2.26	16	$p < .05$*
HR Ante PAT	1.02	0.99	1.05	16	n.s.
HR Light PAT	1.05	1.03	0.47	16	n.s.
HR Neutral Scenes	.98	1.02	-1.44	16	n.s.
HR Phobic Scenes	1.05	1.03	1.03	16	n.s.
SC Ante-PAT	.0400	.0181	1.04	16	n.s.
SC Light-PAT	.1088	.0298	2.00	16	$p < .05$
SC Neutral Scenes	-.0051	-.0027	-.56	16	n.s.
SC Phobic Scenes	-.0040	-.0063	.43	16	n.s.

* - two-tail

TABLE 18

Pre to Follow-up (F.U.) Change Scores for SD and IV

	Group							
	SD				IV			
Measure	Pre	F.U.	t	df	Pre	F.U.	t	df
AAT	7.2	13.1	-8.17	9	7.2	15.5	-16.80	7
AAT Rating	7.3	5.5	2.29	9	6.8	2.6	6.76	7
PAT Rating	6.2	3.3	3.78	9	6.4	2.2	18.20	7
RPQ	6.7	4.6	4.91	9	6.7	2.7	10.68	7
Phobic Scene Rating	5.7	3.6	5.16	9	5.9	2.5	15.38	7
HR-Ante PAT	1.04	1.02	0.96	9	1.06	.99	4.43	7
HR-Light PAT	1.07	1.06	0.36	9	1.17	1.04	2.94	7
HR-Phobic Scenes	1.07	1.06	.096	9	1.07	1.03	1.55	7
GSR-Ante PAT	.0739	.0400	2.23	9	.0650	.0180	2.69	7
GSR-Light PAT	.1205	.1087	0.68	9	.0986	.0298	3.06	7
GSR-Phobic Scenes	.0071	-.0040	1.75	9	.0065	-.0063	1.62	7

TABLE 19

Post to Follow-up Change Analysis for SD and IV

	Group							
	SD				IV			
Measure	Post	F.U.	t	df	Post	F.U.	t	df
AAT	11.7	13.1	-2.20	9	14.1	15.5	-1.33	7
AAT Rating	5.4	5.5	-.18	9	2.62	2.62	0.0	7
PAT Rating	4.0	3.3	1.77	9	2.25	2.25	0.0	7
RPQ	4.7	4.6	0.17	9	2.40	2.72	-.96	7
Phobic Scenes	3.6	3.6	0.0	9	2.5	2.5	0.0	7
HR Scenes	1.04	1.05	-0.87	9	1.04	1.03	0.18	7
SC Scenes	-.0007	-.0039	0.60	9	-.0111	-.0111	-0.69	7
HR Ante	1.00	1.02	-0.62	9	0.96	0.96	-0.88	7
SC Ante	.0500	.0400	0.59	9	-.0027	-.0018	-.86	7
HR PAT	1.08	1.06	0.61	9	1.02	1.03	-0.21	7
SC PAT	.1062	.1087	-0.10	9	.0085	.0297	-0.62	7

posttest to follow-up change analyses respectively. The results on the comparisons listed indicate that there was minimal change in differences from posttest to follow-up. One significant difference at follow-up which was not present at posttest is that for the AAT. IV is significantly higher on the AAT than SD at follow-up. It is, however, important to note that both groups improved over their posttest scores. In addition, SD reported significantly more fear than IV for the AAT at follow-up. This difference was not present at posttest.

Summary of Results

Table 20 summarizes posttest comparisons and analyses of change scores on those variables for which at least one significant finding is present. In the case of posttest comparisons, it is only the IV group which shows significant difference from NT on the physiological indices for the PAT. The SD group differs from NT only on the motor task and the RPQ. This evidence is consistent with the analysis of change scores from pre- to posttest. Here SD and IV show significant improvement on the behavioral task, on all subjective measures, and on autonomic arousal to phobic imagery. It is only the IV group, however, which shows improvement in autonomic arousal to the phobic object. These findings are also true of the pretest to follow-up change scores. The NT group shows only one significant change from pre- to posttest. This is in autonomic arousal to phobic imagery.

One further finding of importance which is not listed in Table 20 is that yielded by the within treatment analyses of SD. These analyses indicated that during SD treatment, Ss showed a significant

TABLE 20

Summary of p Values for Posttest Comparisons and Change Scores

		AAT	AAT Ratings	PAT Ratings	RPQ	Phobic Scenes	HR Scenes	SC Scenes	HR Ante	SC Ante	HR PAT	SC PAT
Posttest Comparisons	SD vs NT	.01	-	-	.05	-	-	-	-	-	-	-
	IV vs NT	.005	.05	.05	.01	-	-	-	.01	.05	.05	.05
	SD vs IV	-	.05	-	.05	-	-	-	-	-	-	.05
Change Scores Pre- to Post	SD	.001	.025	.01	.005	.001	.05	.025	-	-	-	-
	IV	.001	.005	.001	.001	.001	-	.05	.01	.025	.05	.05
	NT	-	-	-	-	-	-	.01	-	-	-	-
Change Scores Pre- to F.U.	SD	.001	.025	.002	.001	.001	-	-	-	-	-	-
	IV	.001	.001	.001	.001	.001	.05	-	.005	.05	.05	.02

reduction in autonomic arousal to the scenes in the hierarchy. Apparently, the reduction in arousal to imagery did not transfer to the actual phobic object at posttest.

CHAPTER IV

DISCUSSION

The purpose of the present study was to gather data relevant to the systematic desensitization process, specifically to the assumption of the transfer of decrements in autonomic arousal from phobic imagery to the actual phobic object. One hypothesis which underlies the efficacy of SD is that such extinction of autonomic arousal is the necessary first step in the elimination of avoidance behavior. This hypothesis is derived from the dual process theory of the conditioned avoidance responses (CAR). Based on such a theory, the extinction of the classically conditioned autonomic response is both a necessary and sufficient cause for the extinction of the motor avoidance response.

According to desensitization theory, the extinction of this physiological arousal is accomplished during SD in the following manner. The individual is first taught to achieve a state of muscular relaxation. This state of relaxation is then used to inhibit anxiety while the individual imagines anxious situations. In other words, he ceases to experience autonomic arousal to phobic imagery. Once this goal is achieved, generalization of this reduction in autonomic arousal to the real object occurs and a change in avoidance behavior follows.

An abundance of evidence exists which indicates that SD does, in fact, lead to a significant reduction in avoidance behavior (see Paul,

1969 a & b). In addition, several studies have shown that a decrease in autonomic arousal to phobic imagery does accompany the application of SD or variant procedures (Agras, 1965; Lang et. al., 1970; Paul, 1969 c & d; Wolpe & Flood, 1970). It is a simple logical step, then, to conclude that SD must produce similar autonomic reductions in response to the real phobic object. In fact, this assumption seems so reasonable that little research has directly investigated it. The evidence that does exist, however, suggests that a transfer from imagery to reality may not be present (Barlow et. al., 1969).

In order to test this assumption of transfer in the present study, two questions had to be examined. The first is whether reduction in arousal to phobic imagery had occurred in the SD and IV groups and, secondly, if such reductions did occur, did they transfer to the actual object. With respect to the first question, autonomic decrements to phobic imagery were not only evident in the SD and IV groups, but also in the NT group. Such a finding dismisses any conclusion of a causal relationship between the treatments employed and the subsequent reduction in arousal to imagery. Nonetheless, significant reductions in arousal to phobic imagery were apparent at posttest. In addition, analyses of within session physiological data for the SD group revealed that with repeated presentations of phobic scenes, S's autonomic responses tended to habituate.

With respect to the second question, it is clear that this reduction in arousal to imagery did not generalize to the actual object for the SD group. Only the IV group showed significant autonomic reductions in response to the actual phobic object.

Clearly, the results of the present study fail to support the assumption of transfer. The autonomic decrements to phobic imagery evident during treatment and at posttest for the SD group did not generalize to the actual object. In addition, the fact that behavior change occurred despite this failure to generalize indicates that the dual process hypothesis has little relevance as an explanation of SD's efficacy. The extinction of autonomic responding to the phobic object is not a necessary condition for behavior change. These conclusions have several implications regarding the desensitization process and its investigation.

In the first place, Wolpe's theoretical formulation of SD's efficacy becomes untenable and the question of how SD works remains unresolved. Results from the present study do not bear on this issue, nor is an exhaustive review of alternative explanations of the desensitization process appropriate here. The present results indicate that further investigations into the effective processes of SD are in order. While investigations of alternative explanations are presently being conducted, it is still premature to select one such explanation as the best. Depending upon one's biases, one is bound to be more impressed with some explanations than with others. There is, however, a tendency to reject learning models as explanatory tools. While the results of the present study and others may not support the original learning principles employed in explaining SD's efficacy, the dismissal of learning principles altogether does not follow. Alternative learning explanations of SD do exist and warrant investigation.

The results from the present study also raise some serious

questions regarding the investigation of phychophysiological concomitants of the systematic desensitization process. Recent years have witnessed a plethora of studies in this area (see Mathews, 1971). Many of these studies concentrate on the nature of physiological responses to imagery. For example, a recent study by Lang et. al. (1970) investigated the course of Ss' autonomic activity in response to scene presentations during systematic desensitization. The assumption underlying such an investigation is that a reduction in autonomic arousal to phobic images supports the dual process explanation of desensitization's efficacy. The generalization of that physiological reduction to the actual object is simply assumed despite the fact that no evidence in support of such a generalization is available. The fact that SD produced significant behavioral changes made such evidence apparently unnecessary. The adoption of the dual process position ruled out the possibility that the transfer of autonomic decrements from imagery to reality had not occurred. Such decrements were considered a necessary cause for behavior change. Therefore, evidence of behavior change was seen as sufficient evidence that generalization had occurred. This reasoning underlies other studies which have looked at the relationship of autonomic activity to phobic imagery (e.g., Agras, 1965; Edelman, 1971; Grossberg & Wilson, 1968; Paul, 1969 a & b; Paul & Trimble, 1970; Van Egeren, 1970; Van Egeren, Feather & Hein, 1971; Wolpe & Flood, 1970).

While these studies are of direct interest with respect to phobic imagery, they cannot be taken to support the presence of transfer. It is evident from the present results that the assumptions made

regarding the generalization of the extinction of the autonomic component of the fear response from imagery to actuality is unwarranted. Conversely, results from the present study point to some interesting considerations with respect to the effect of autonomic extinction to the actual object. While it is true that behaviorally, SD Ss showed significant improvement over NT Ss despite continued autonomic arousal to the actual object, it is also apparent that the extinction of such arousal does play a role in behavioral change. Of the two treated groups, it was the IV that showed a truly dramatic change on almost all measures. In addition, this group was the only one to show physiological changes in response to the actual phobic object. While the data presented here do not provide convincing evidence for the presence of any causal links between motor and physiological changes, it is possible that the dramatic global changes in IV S's fear responses to the rat were at least in part due to an extinction of their autonomic responsivity. Conversely, such changes in motor and cognitive aspects of the fear response may be the source of changes in autonomic aspects. In either case, additional research is necessary to explicate the nature of what are surely complex interrelationships.

The results from the present study do have direct implications for treatment of fearful behavior. Of the two treatment procedures employed, it was the group which had direct contact with the feared object which showed the most dramatic change in all components of the fear response. This has been a consistent finding in studies which have employed similar contact procedures (e.g., Barlow, et. al., 1969; Cooke, 1966; Ritter, 1968). The belief that direct contact with the

phobic object necessarily impedes therapeutic progress is clearly unjustified. The present results and those of other investigations indicate that such procedures can facilitate treatment.

The consistent data in support of the above conclusion should not be ignored in a clinical setting. It is often simpler and less effortful in the short run to apply imaginal desensitization. The possibility of an in vivo approach is often ignored. In terms of therapist and patient time and effort, in vivo procedures should, in fact, lead to more efficient overall treatment. Of course, certain situations invariably arise where the application of contact desensitization is highly impractical, if not impossible. All too often, however, the possibility of in vivo treatment is eliminated prematurely, and its potentially beneficial results are never realized.

One final issue which requires discussion is the appropriateness of an analogue study such as this one. Unless the design of the present study allows for reasonable generalization from laboratory to clinic, the foregoing conclusions and interpretations have little value. Some serious criticisms of analogue research have recently been offered by Cooper, Furst, and Bridger (1969) and Bernstein and Paul (1971). In general, the major concern is whether the Ss and treatment procedure permit the generalization of the findings to the clinical setting. This generalization is permissible in the present study with respect to both subjects and treatment.

Subjects used in the present study displayed significant fear of rats by most criteria used in analogue research. As a group, they reported considerable anxiety on questionnaires and ratings, they

displayed physiological arousal to the rats, and they refused to touch the rat despite apparent experimental demands to do so if at all possible.

In addition, the generalizability from analogue treatment to clinical treatment is an important consideration. While there are obvious differences between the analogue procedure used here and SD as employed in the clinical setting, this problem is of minimal importance in the present study. First, the analogue treatment employed in the present study was accompanied by significant behavioral and cognitive changes. It is clear that the technique of SD used in this study was capable of producing a change in behavior despite its failure to produce a concomitant change in physiological arousal. Secondly, the within treatment analyses showed that the application of the technique was accompanied by reductions in physiological arousal to phobic imagery. It is difficult to conclude, therefore, that the application of a form of desensitization more closely related to the clinically applied desensitization procedure would have produced results significantly different from those of the present study.

If the results from the present study are justifiably extended to the clinical application of SD, then the conclusions drawn can be extended. In summary, these conclusions are:

(1) Reductions in autonomic responsivity to phobic imagery do not necessarily transfer to the actual phobic object.

(2) Significant behavior change toward the phobic object can occur despite a failure to achieve extinction of autonomic arousal to that object.

(3) As a result, alternative explanations of SD's efficacy must be carefully evaluated in order to maximize the efficiency of treatment for fear motivated behavior.

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APPENDICES

APPENDIX A

Rat Phobia Questionnaire

INSTRUCTIONS: Imagine that you are in a room which is approximately 15 feet long. At one end of the room there is a cage which contains a white rat. The cage is covered and it is impossible for the animal to escape from its enclosure. Keep this scene in mind as you answer the following questions.

1. In the above situation how anxious would you be? (Circle the number on the scale which best fits your level of anxiety.)

1 2 3 4 5 6 7 8 9
No anxiety Extreme anxiety

2. If you were to reach into the cage and touch the rat with your bare hands, how anxious would you feel?

1 2 3 4 5 6 7 8 9
No anxiety Extreme anxiety

3. How anxious would you feel if you were to pick up and hold the rat with your bare hands?

1 2 3 4 5 6 7 8 9
No anxiety Extreme anxiety

4. If you were to approach the cage and look down at the animal inside it through the glass cover, how anxious would you feel?

1 2 3 4 5 6 7 8 9
No anxiety Extreme anxiety

5. If, with a gloved hand, you were to reach into the cage and touch the rat, how anxious would you feel?

1 2 3 4 5 6 7 8 9
No anxiety Extreme anxiety

APPENDIX B

AAT Checklist

Please check the item which corresponds to your furthest point of progress. Below the list is a space for an anxiety rating. Please select a rating from one to nine, as was done in the previous tasks, that corresponds with the level of anxiety you experienced while performing the item you checked.

1. Standing outside of door of testing room ( )
2. Opening door to testing room ( )
3. Entering room and looking at cage at opposite end of room ( )
4. Standing six feet away from the cage ( )
5. Standing 3½ feet away from the cage ( )
6. Standing 1½ feet away from the cage ( )
7. Standing next to cage and looking down at the rat ( )
8. Placing palm against glass nearest rat ( )
9. Opening cage ( )
10. Looking down at the rat ( )
11. Placing hand into the cage without touching the rat once ( )
12. Placing gloved hand into cage and touching the rat once ( )
13. Putting bare hand into cage and touching the rat once ( )
14. Reaching into cage and petting the rat with bare hand ( )
15. Reaching into cage and lifting the rat off the floor briefly ( )
16. Reaching into cage, picking up the rat, and letting it rest on your left arm, which you are holding against your stomach ( )

Anxiety Rating _____

APPENDIX C

Neutral and Phobic Scenes

I. Neutral Scenes

(A) Imagine yourself walking down a path here at the University. It is a pleasant spring day and you have nothing much on your mind.

(B) Imagine yourself sitting at home, watching television.

(C) Imagine yourself sitting on a park bench on a pleasant day.

(D) Imagine yourself relaxing at home, listening to music.

II. Phobic Scenes

(A) Imagine that you are standing six to ten feet away from a white rat in a covered glass cage.

(B) Imagine yourself reaching into a cage, picking up a white rat, petting it, and allowing it to crawl on your arm.

(C) Imagine that the light in the next room has gone on, and you see a rat in a glass cage. The rat will then leave the cage and run down the plank toward you.

APPENDIX D

Relaxation Training

We are now ready to begin. The important thing is for you to get as comfortable as you can. Make sure that your back and neck are adequately supported. Your legs should be extended and not crossed. Place your arms comfortably on the sides of your chair. Rest your head against the back of the chair. No parts of your body should require the use of muscles for support. Now make yourself as comfortable as you can and you are now ready to begin relaxation. When relaxing, do not try too hard. Merely follow the instructions as accurately as you can but without thinking about them as you do so. Just obey them passively and automatically and you will thereby achieve a maximum freedom from tension. Now get as comfortable as you can, close your eyes, and let go of all the muscles in your body. (6 seconds)

Tense the muscles of your right arm. Make them very tight and very tense...very tight and very tense (6 seconds). O.K., relax. Let the tension leave those muscles. Pay attention to how it feels as the tension leaves those muscles. Let those muscles relax. Let the tension leave them (7 seconds). O.K., once again, tense the muscles of your right arm. Get them very tight and very tense...very tight and very tense (5 seconds). O.K., relax. Let the tension leave those muscles. Let them relax. Pay attention to how it feels as the tension leaves those muscles, as the tension leaves those muscles and they become relaxed (10 seconds).

Tense the muscles of your left arm. Make them very tight and very tense...very tight and very tense (5 seconds). O.K., relax. Let the tension leave those muscles. Pay attention to how it feels as the tension leaves those muscles, as they become relaxed. The tension leaves and they become more and more relaxed, less tense, more relaxed (4 seconds). Once again, tense the muscles of your left arm. Get those muscles very tight and very tense...very tight and very tense. O.K., relax. Let the tension leave those muscles. Pay attention to how it feels as the tension leaves those muscles, as they become relaxed, they become less tense, more relaxed, less tense, more and more relaxed (6 seconds).

O.K., now frown hard, tensing the muscles of your forehead and the top of your head. Get those muscles very tight and very tense...very tight and very tense (5 seconds). O.K., relax. Let the tension leave those muscles. Pay attention to how it feels as the tension leaves those muscles, as they become more and more relaxed, they become less tense and more relaxed. Pay close attention to those muscles and how they feel as the tension leaves and they become more and more relaxed (3 seconds). Once again, I want you to frown hard, tensing the muscles of your forehead and the top of your head. Get those muscles very tight and very tense, very tight and very tense. O.K., relax. Let the tension leave

APPENDIX D (Cont'd)

those muscles. Pay attention to how it feels as the tension leaves those muscles, they become relaxed, as they become less tense and more relaxed, less tense, more and more relaxed. Pay very close attention to those muscles as the tension leaves them and they become more and more relaxed (6 seconds).

Now, wrinkle your nose, feeling the muscles across the top of your cheeks and upper lip. Get those muscles very tight and very tense... very tight and very tense. O.K., relax. Let the tension leave those muscles. Pay attention to how it feels as the tension leaves those muscles, as they become relaxed, as they become less tense and more relaxed, less tense, more and more relaxed. Pay close attention to those muscles as the tension leaves them, and they become more and more relaxed. Once again, wrinkle your nose, feeling the muscles across the top of your cheeks and upper lip. Get those muscles very tight and very tense, very tight and very tense. O.K., relax. Let the tension leave those muscles. Pay attention to how it feels as the tension leaves those muscles, and they become more and more relaxed, they become less tense and more relaxed, less tense, more and more relaxed. Pay very close attention to those muscles as the tension leaves them and they become more and more relaxed (5 seconds).

Now draw back the corners of your mouth feeling your jaw muscles and your cheek muscles. Get those muscles very tight and very tense, very tight and very tense. O.K., relax. Let those muscles relax, let the tension leave those muscles, pay attention to how it feels as the tension leaves those muscles, as they become more and more relaxed, become less tense and more relaxed, less tense, more and more relaxed, less tense, more and more relaxed. Once again, draw back the corners of your mouth feeling your jaw muscles and the muscles in your cheeks. Get those muscles very tight and very tense, very tight and very tense. O.K., relax. Let those muscles relax. Let the tension leave those muscles, pay attention to how it feels as the tension leaves those muscles and they become more and more relaxed. Pay very close attention to those muscles and how they feel as they become more and more relaxed, more and more relaxed (5 seconds).

Now, tighten your chin and throat muscles feeling the two muscles in the front of your throat. Get those muscles very tight and very tense, very tight and very tense. O.K., relax. Let those muscles relax. Let the tension leave those muscles. Pay attention to how it feels as the tension leaves those muscles and they become more and more relaxed, they become less tense and more relaxed, less tense, more and more relaxed. Pay close attention to those muscles as the tension leaves and they become more and more relaxed (5 seconds). Once again, tighten your chin and throat muscles feeling in particular the two muscles in front of the throat. Get those muscles very tight and very tense, very tight and very tense. O.K., relax. Let the tension leave those muscles. Pay attention

APPENDIX D (Cont'd)

to how it feels as the tension leaves those muscles as they become more and more relaxed, become less tense and more relaxed, less tense, more and more relaxed. Pay attention to how it feels as the tension leaves those muscles, and they become more and more relaxed, more and more relaxed (5 seconds).

Now, tighten your chest muscles and the muscles across your back. Feel the muscles pull below your shoulder blades. Get those muscles very tight and very tense, very tight and very tense. O.K., relax. Let those muscles relax, let the tension leave those muscles. Pay attention to how it feels as the tension leaves those muscles, as they become more and more relaxed, become less tense and more relaxed, less tense, more and more relaxed, more and more relaxed. Once again, tighten your chest muscles and the muscles across your back. Feel the muscles pull below your shoulder blades. Get those muscles very tight and very tense...very tight and very tense. O.K., relax. Let those muscles relax. Pay attention to how it feels as those muscles relax, as the tension leaves and they become more and more relaxed, less tense, more and more relaxed. Pay attention to how it feels as the tension leaves those muscles and they become more and more relaxed, less tense more and more relaxed (5 seconds).

Now, tighten your abdominal muscles. Make your abdomen hard. Get those muscles very tight and very tense, very tight and very tense. O.K., relax. Let those muscles relax, let the tension leave those muscles. Pay attention to how it feels as the tension leaves those muscles, as they become less tense and more relaxed, less tense, more and more relaxed. Pay very close attention to how it feels as the tension leaves those muscles and they become more and more relaxed, more and more relaxed. Once again, tighten your abdominal muscles. Make your abdomen hard. Get those muscles very tight and very tense, very tense and very tense. O.K., relax. Let the tension leave those muscles. Pay attention to how it feels as the tension leaves those muscles, as they begin to relax, as they become more and more relaxed, less tense, more and more relaxed. Pay very close attention to how it feels as the tension leaves those muscles, as they become more and more relaxed, less tense, more and more relaxed (5 seconds).

O.K., now tighten the muscles of your right upper leg. Get those muscles very tight and very tense. Very tight and very tense. O.K., relax. Let the tension leave those muscles. Pay attention to how it feels as the tension leaves those muscles, as they become more and more relaxed, become less tense, more and more relaxed. Pay attention to how it feels as the tension leaves those muscles, they become more and more relaxed, less tense, more relaxed, less tense, more and more relaxed (5 seconds). Once again, tighten the muscles of your right upper leg. Get those muscles very tight and very tense, very tight and very tense. O.K., relax. Let those muscles relax. Pay attention to

APPENDIX D (Cont'd)

how it feels as the tension leaves those muscles, as they become more and more relaxed, become less tense, more and more relaxed, less tense, more and more relaxed. Pay attention to how it feels as the tension leaves those muscles and they become more and more relaxed, become less tense, more and more relaxed (5 seconds).

Now, tighten the muscles of your right calf. Get those muscles as tight and as tense as you can get them...very tight and very tense. O.K., relax. Let those muscles relax. Let the tension leave those muscles. Pay attention to how it feels as the tension leaves those muscles, as they become more and more relaxed, less tense, more and more relaxed, less tense, more and more relaxed. Pay attention to how it feels as the tension leaves those muscles as they become more and more relaxed (5 seconds). Once again, tighten the muscles of your right calf. Get those muscles very tight and very tense, very tight and very tense. O.K., relax. Let the tension leave those muscles. Pay attention to how it feels as the tension leaves those muscles, as they become more and more relaxed, as they become less tense, more and more relaxed, less tense, more and more relaxed. Pay attention to how it feels as the tension leaves those muscles, as they become less tense and more relaxed, less tense, more and more relaxed (5 seconds).

Now, push down with the toes of your right foot and arch that foot. Get those muscles very tight and very tense, very tight and very tense. O.K., relax. Let the tension leave those muscles. Pay attention to how it feels as the tension leaves those muscles, as they become more and more relaxed, less tense, more and more relaxed. Pay attention to how it feels as the tension leaves those muscles, as they become more and more relaxed, less tense, more and more relaxed. Once again, push down with your toes and arch your right foot. Get those muscles very tight and very tense, very tight and very tense. O.K., relax. Let those muscles relax. Let the tension leave those muscles. Pay attention to how it feels as the tension leaves those muscles, as they become more and more relaxed, as they become less tense and more relaxed, less tense, more and more relaxed, less tense, more and more relaxed. Pay attention to how it feels as the tension leaves those muscles, and they become more and more relaxed, less tense, more and more relaxed (5 seconds).

Now tense the muscles of your left upper leg. Get those muscles very tight and very tense, very tight and very tense. O.K., relax. Let those muscles relax. Pay attention to how it feels as those muscles relax, as the tension leaves, as they become relaxed, become less tense, more relaxed, less tense, more and more relaxed. Pay very close attention to those muscles and how they feel as the tension leaves and they become more and more relaxed, become less tense, more and more relaxed. Once again, tense the muscles of your left upper leg. Get those muscles very tight and very tense, very tight and very tense. O.K., relax. Let those muscles relax. Pay attention to how it feels as those muscles

APPENDIX D (Cont'd)

relax, as the tension leaves, as they become more and more relaxed, become less tense, more relaxed, less tense, more and more relaxed. Pay very close attention to how it feels as the tension leaves those muscles, they become more and more relaxed, less tense, more and more relaxed (5 seconds).

Tense the muscles of your left calf, getting those muscles very tight and very tense, very tight and very tense. O.K., relax. Let those muscles relax. Let the tension leave those muscles. Pay attention to how it feels as the tension leaves those muscles, as they become more and more relaxed, become less tense, more relaxed, less tense, more and more relaxed. Pay attention to how it feels as the tension leaves those muscles, they become more and more relaxed, less tense, more and more relaxed, less tense, more and more relaxed. Again, tense the muscles of your left calf. Get those muscles very tight and very tense, very tight and very tense. O.K., relax. Let the tension leave those muscles. Pay attention to how it feels as the tension leaves those muscles, as they become more and more relaxed, become less tense, more and more relaxed. Pay very close attention to those muscles and how they feel as the tension leaves and they become more relaxed, more and more relaxed, more and more relaxed (5 seconds).

Push down with your toes and arch your left foot. Get those muscles very tight and very tense, very tight and very tense. O.K., relax. Let those muscles relax. Let the tension leave those muscles. Pay attention to how it feels as the tension leaves those muscles, as they become more and more relaxed, less tense, more and more relaxed, less tense, more and more relaxed. Pay attention to how it feels as the tension leaves those muscles and they become more and more relaxed. Once again, press down with your toes and arch your left foot. Get those muscles very tight and very tense, very tight and very tense. O.K., relax. Let the tension leave those muscles. Pay attention to how it feels as the tension leaves those muscles, as they become more and more relaxed, as they become less tense, more and more relaxed, less tense, more and more relaxed. Pay very close attention to those muscles and how they feel, as the tension leaves and they become more and more relaxed, more and more relaxed. Go on relaxing. Pay close attention to all your muscles and how relaxed they feel. Let the tension leave, let yourself become more and more relaxed, more and more deeply relaxed. Pay close attention to all the muscles in your body and how relaxed they feel, no tension anywhere, very relaxed, very calm, very comfortable. Let yourself become more and more relaxed, let any tension leave, let yourself become more and more relaxed, very comfortable, very calm, very relaxed, more and more deeply relaxed, more and more deeply relaxed. Pay attention to how it feels now that your muscles are relaxed, as the tension leaves, as they become more and more relaxed, as the tension leaves and they become more and more relaxed, less tense, more and more relaxed, more and more relaxed. You feel very calm, very comfortable,

APPENDIX D (Cont'd)

very, very relaxed. More and more deeply relaxed. Pay attention to how it feels now that your muscles are very relaxed, the tension leaves and they become more and more relaxed, more and more relaxed, very calm, very comfortable, very relaxed, very deeply relaxed, more and more relaxed, more and more relaxed. Just continue relaxing paying attention to your muscles and how relaxed they feel, letting yourself all the time become more and more deeply relaxed, more and more deeply, deeply relaxed.

APPENDIX E

Hierarchy

1. Standing outside the door of the testing room in which you saw the rat.
2. Opening the door to the testing room.
3. Entering the testing room and looking at the glass cage ten feet away.
4. In the testing room, six feet away from the cage.
5. 3½ feet from the rat.
6. 1½ feet from the cage.
7. Standing right next to the cage looking down at the rat.
8. Palm against the cage.
9. Lifting lid from cage and placing it on table.
10. Standing over cage looking down at rat.
11. Lowering hand into cage, not touching rat.
12. Touching rat's back with gloved hand.
13. Touch rat with bare hand.
14. Petting rat with bare hand.
15. Lift rat briefly off floor of cage with bare hand.
16. Lift rat out of cage with bare hand and place him on your left arm which is against your stomach.

APPENDIX F

Raw Data

AAT

	SD	IV	NT
PRE	10	6	6
	5	5	7
	7	10	10
	11	8	10
	6	6	8
	7	8	8
	9	9	8
	5	6	7
	7		8
	5		
POST	14	10	7
	16	16	7
	9	16	10
	14	16	12
	13	16	10
	11	16	8
	14	16	7
	8	7	8
	8		8
	10		
FOLLOW-UP	14	15	
	15	15	
	14	16	
	14	16	
	14	16	
	14	16	
	14	16	
	8	14	
	12		
	12		

APPENDIX F (Cont'd)

AAT RATING

	SD	IV	NT
PRE	8	7	5
	6	7	9
	9	7	6
	7	8	7
	7	7	8
	8	4	3
	5	8	7
	9	6	6
	6		7
	8		
POST	2	5	9
	1	4	9
	6	1	7
	7	1	7
	8	4	3
	8	3	2
	3	2	4
	8	1	5
	5		7
	6		
FOLLOW-UP	1	4	
	2	4	
	9	1	
	6	2	
	7	2	
	6	3	
	4	3	
	9	2	
	7		
	4		

APPENDIX F (Cont'd)

PAT RATING

	SD	IV	NT
PRE	6	7	7
	5	7	8
	7	5	7
	6	7	5
	8	6	6
	8	6	3
	3	6	6
	9	7	4
	2		8
	8		
POST	2	4	9
	3	3	9
	7	1	8
	3	1	5
	7	3	2
	2	3	4
	1	2	7
	9	1	2
	2		8
	4		
FOLLOW-UP	1	3	
	2	3	
	5	1	
	4	2	
	4	2	
	1	2	
	1	3	
	9	2	
	3		
	3		

APPENDIX F (Cont'd)

Vividness-Neutral Scenes

	SD	IV	NT
PRE	4.0	3.8	3.5
	3.5	3.5	4.0
	4.0	3.5	3.0
	3.0	3.0	3.5
	4.0	4.0	3.8
	3.8	3.5	3.3
	2.5	4.0	3.0
	2.8	3.0	3.0
	3.2		4.0
	3.8		
POST	4.0	3.0	3.5
	3.5	3.0	3.5
	4.0	3.5	3.2
	2.2	4.0	3.5
	4.0	4.0	4.0
	4.0	3.8	3.5
	2.8	3.8	3.0
	2.8	3.8	3.5
	2.5		4.0
	3.8		
FOLLOW-UP	4.0	3.0	
	3.8	3.2	
	4.0	3.8	
	3.2	4.0	
	4.0	4.0	
	3.0	4.0	
	3.2	3.8	
	2.8	4.0	
	2.5		
	4.0		

APPENDIX F (Cont'd)

Vividness--Phobic Scenes

	SD	IV	NT
PRE	4.0	3.7	3.0
	3.7	3.7	3.7
	3.0	3.7	3.3
	3.3	3.3	3.0
	3.7	4.0	3.3
	3.0	2.3	3.3
	3.3	3.7	3.3
	3.7	3.7	3.0
	3.3		4.0
	3.7		
POST	4.0	3.7	3.3
	3.3	4.0	4.0
	4.0	4.0	3.3
	3.3	3.0	3.0
	3.7	4.0	4.0
	3.3	4.0	3.7
	3.0	4.0	3.3
	4.0	4.0	3.3
	2.7		4.0
	3.7		
FOLLOW-UP	4.0	3.7	
	3.0	3.3	
	4.0	4.0	
	3.3	4.0	
	3.7	4.0	
	3.0	4.0	
	3.3	3.7	
	3.7	4.0	
	2.0		
	3.3		

APPENDIX F (Cont'd)

Mean Anxiety Rating for Neutral Scenes

	SD	IV	NT
PRE	1.0	1.0	1.2
	1.0	2.0	1.2
	1.8	1.0	1.0
	1.0	1.0	1.0
	1.0	2.5	1.0
	1.0	1.2	1.5
	1.0	1.2	1.0
	1.8	1.2	1.0
	1.0		1.0
	1.0		
POST	1.0	1.5	1.0
	1.0	1.2	1.5
	1.0	1.0	1.0
	1.0	1.0	1.0
	1.0	1.5	1.0
	1.2	1.0	1.0
	1.0	1.0	1.0
	1.5	1.0	1.0
	1.0		1.0
	1.0		
FOLLOW-UP	1.0	1.2	
	1.0	1.2	
	1.0	1.0	
	1.0	1.0	
	1.2	1.0	
	1.5	1.2	
	1.0	1.2	
	1.5	1.0	
	1.0		
	1.0		

APPENDIX F (Cont'd)

Mean Anxiety Rating for Phobic Scenes

	SD	IV	NT
PRE	6.3	6.3	6.0
	5.0	7.7	7.7
	5.7	5.0	4.3
	6.0	4.0	5.3
	6.7	6.7	6.0
	7.3	3.7	1.7
	4.3	6.7	4.7
	7.7	7.3	2.7
	3.3		7.3
	5.3		
POST	2.3	4.0	5.7
	3.0	3.0	7.0
	4.7	1.0	4.3
	3.3	1.3	5.0
	3.7	3.7	2.3
	4.7	2.7	1.3
	2.7	3.0	2.3
	8.0	1.7	2.7
	1.7		7.3
	2.3		
FOLLOW-UP	2.7	3.3	
	2.7	3.3	
	3.3	1.3	
	4.3	1.0	
	4.0	2.7	
	4.0	1.3	
	2.3	3.3	
	8.3	3.7	
	2.7		
	2.0		

APPENDIX F (Cont'd)

Mean RPQ Score

	SD	IV	NT
PRE	5.8	6.2	7.0
	5.4	7.6	6.8
	8.2	6.6	5.6
	7.4	5.8	6.8
	7.2	6.2	5.2
	7.0	7.2	4.8
	5.6	7.0	5.4
	8.2	6.8	5.0
	6.2		7.0
	6.4		
POST	1.4	4.0	7.9
	2.2	2.4	7.5
	5.0	1.0	4.7
	5.2	1.0	6.7
	6.6	3.2	5.3
	6.6	3.8	5.9
	3.2	2.6	6.5
	9.0	1.2	5.3
	3.0		7.7
	5.0		
FOLLOW-UP	2.0	4.2	
	2.2	3.2	
	6.8	1.2	
	5.6	1.2	
	4.6	2.6	
	4.0	2.6	
	2.2	3.8	
	8.8	3.0	
	4.8		
	5.4		

APPENDIX F (Cont'd)

Mean HR--Netural Scenes

	SD	IV	NT
PRE	.98	1.04	.96
	.96	.92	.97
	1.06	1.00	1.02
	1.07	1.02	1.00
	1.03	1.00	1.03
	1.00	1.02	.90
	1.00	1.00	.98
	.96	.92	1.00
	.96		.96
	1.06		
POST	.93	.96	.94
	1.02	1.02	.96
	1.04	.99	1.04
	1.08	1.00	1.02
	.96	.98	1.02
	.99	1.04	.96
	1.02	.98	1.02
	1.07	1.04	1.00
	1.08		.98
	.94		
FOLLOW-UP	1.00	1.14	
	.97	.98	
	1.05	1.02	
	.94	1.04	
	.97	1.00	
	1.01	.98	
	.96	.98	
	.98	1.00	
	.98		
	1.02		

APPENDIX F (Cont'd)

Mean HR--Phobic Scenes

	SD	IV	NT
PRE	1.03	1.10	.92
	1.06	1.03	1.05
	1.08	1.00	1.27
	1.13	1.03	.95
	1.10	1.12	1.15
	1.03	1.09	1.05
	1.08	1.08	1.03
	1.10	1.10	1.00
	1.05		1.08
	1.05		
POST	.97	1.08	.98
	1.08	1.08	1.03
	1.07	1.09	1.18
	1.10	1.03	1.02
	.98	.93	1.00
	1.04	.98	.85
	.97	1.08	.89
	1.03	1.02	1.08
	1.10		1.04
	1.03		
FOLLOW-UP	1.11	1.09	
	.98	1.09	
	1.05	1.03	
	1.11	1.00	
	1.00	1.00	
	1.06	1.00	
	1.07	1.06	
	1.02	1.00	
	1.10		
	1.05		

APPENDIX F (Cont'd)

Mean SC--Neutral Scenes

	SD	IV	NT
PRE	-.0007	-.0011	.0015
	-.0051	-.0080	-.0150
	.0058	.0088	-.0004
	-.0090	-.0034	-.0044
	-.0014	-.0186	.0056
	.0016	.0009	-.0012
	.0009	-.0002	.0065
	-.0050	.0027	.0083
	.0066		-.0114
	-.0021		
POST	-.0014	.0014	-.0116
	.0001	-.0163	-.0163
	-.0163	.0011	-.0018
	.0014	-.0006	-.0112
	-.0034	-.0396	-.0005
	.0007	-.0230	-.0127
	.0006	-.0144	.0002
	.0021	.0039	.0023
	-.0045		-.0071
	-.0004		
FOLLOW-UP	.0003	.0041	
	-.0036	.0076	
	-.0007	.0009	
	-.0087	-.0028	
	-.0118	-.0134	
	.0004	-.0150	
	.0017	-.0016	
	.0026	-.0006	
	-.0310		
	-.0005		

APPENDIX F (Cont'd)

Mean SC--Phobic Scenes

	SD	IV	NT
PRE	-.0026	.0003	-.0004
	.0026	.0470	.0447
	-.0005	-.0066	.0123
	.0142	-.0113	.0017
	.0010	.0060	-.0007
	.0029	.0034	-.0171
	.0159	.0086	.0328
	.0176	.0045	-.0055
	.0239		.0268
	-.0037		
POST	-.0008	.0015	-.0265
	.0014	.0024	.0181
	-.0145	.0036	-.0009
	-.0053	-.0004	-.0014
	.0020	-.0324	-.0087
	.0003	-.0282	-.0291
	-.0019	-.0434	.0007
	.0017	.0078	-.0024
	.0100		-.0146
	.0001		
FOLLOW-UP	.0005	-.0042	
	.0153	-.0135	
	.0003	.0054	
	-.0112	-.0056	
	-.0161	-.0114	
	.0008	-.0200	
	.0029	.0014	
	.0034	-.0027	
	-.0344		
	-.0014		

APPENDIX F (Cont'd)

HR--Ante PAT

	SD	IV	NT
PRE	1.09	.96	1.09
	.99	1.13	1.04
	1.00	1.01	1.08
	1.03	1.04	1.03
	1.07	1.12	1.16
	1.00	1.01	1.06
	1.14	1.13	1.02
	.95	1.14	.98
	1.08		1.02
	1.05		
POST	.77	1.02	1.01
	.97	.97	1.00
	.98	.95	1.09
	1.05	.95	1.01
	1.13	.94	1.03
	1.00	.94	1.17
	1.07	.97	1.01
	.94	.96	1.02
	.98		1.11
	1.06		
FOLLOW-UP	1.12	.84	
	.96	1.07	
	1.05	1.00	
	1.02	1.00	
	1.06	.97	
	.99	.96	
	1.01	1.07	
	1.03	1.01	
	.98		
	.98		

APPENDIX F (Cont'd)

SC--Ante PAT

	SD	IV	NT
PRE	.0018	.1055	.0677
	.0460	.0881	.0386
	.0345	.1071	.0306
	.1726	.0071	.1004
	.0434	.0783	.0989
	.0015	.0133	.0702
	.0006	.0948	-.0191
	.1384	.0262	-.0104
	.1597		.1635
	.1408		
POST	.0022	.0312	.0759
	.0054	.1160	.1361
	.1224	.0199	.0696
	.1367	-.0020	.0643
	.0541	-.0806	.1064
	.0004	-.1424	.0194
	.0194	.0336	.0257
	.0385	.0025	.0085
	.0445		.1031
	.0766		
FOLLOW-UP	.0098	.0135	
	.0406	.0397	
	.0089	.0297	
	.1281	-.0002	
	.0578	-.0030	
	-.0463	-.0084	
	.0183	.0017	
	.0215	.0717	
	.1309		
	.0307		

APPENDIX F (Cont'd)

HR--Light Period

	SD	IV	NT
PRE	1.05	1.02	1.09
	1.04	1.42	1.10
	1.18	1.07	1.16
	1.03	1.13	1.04
	1.13	1.18	1.14
	.96	1.12	1.06
	1.09	1.17	1.01
	.96	1.28	.99
	1.08		1.08
	1.19		
POST	1.00	1.12	1.14
	1.04	1.04	1.18
	1.06	1.02	1.32
	1.04	1.23	1.12
	1.20	.89	1.11
	1.10	.92	1.00
	1.07	.99	1.18
	.99	.97	1.00
	1.04		1.33
	1.27		
FOLLOW-UP	1.08	.85	
	.98	1.10	
	1.07	1.21	
	1.03	1.01	
	.97	.95	
	1.05	.95	
	.97	1.09	
	1.23	1.12	
	1.03		
	1.16		

APPENDIX F (Cont'd)

SC--Light Period

	SD	SD	NT
PRE	.1075	.1014	.0949
	.0866	.2147	.0443
	.0384	.0841	.0576
	.1917	.0161	.1163
	.0877	.1520	.1082
	.0070	.0308	.1319
	.0959	.1510	.0095
	.2214	.0387	.0322
	.1775		.3318
	.1922		
POST	.0800	.0484	.2450
	.0542	.1858	.2835
	.1762	.0360	.1209
	.2070	.0053	.1839
	.1127	-.1218	.1502
	.0068	-.1949	-.0175
	.0253	.0786	.1000
	.1712	.0308	.0170
	.0771		.1696
	.1521		
FOLLOW-UP	.0176	.0001	
	.1026	.0713	
	.0162	.0499	
	.2608	.0087	
	.0993	.0046	
	-.0320	-.0062	
	.0280	.0481	
	.2911	.0617	
	.1674		
	.1366		

APPENDIX F (Cont'd)

Mean HR--Ante BAT

	SD	IV	NT
PRE	1.04	1.11	.92
	.99	1.21	.99
	1.10	1.00	1.02
	1.00	.98	1.03
	1.13	1.00	1.04
	.98	.98	1.03
	1.00	1.11	1.03
	1.03	.96	1.01
	1.06		1.11
	1.16		
POST	1.22	1.02	.94
	1.04	1.04	1.02
	1.01	1.04	1.02
	1.02	1.05	1.01
	1.12	.96	1.06
	.94	.96	.90
	1.12	1.04	.96
	1.19	1.04	1.04
	1.00		1.18
	1.05		
FOLLOW-UP	.98	1.00	
	1.02	1.00	
	1.06	1.12	
	.97	1.01	
	1.06	.99	
	1.23	1.02	
	1.18	1.08	
	1.00	1.06	
	1.02		
	1.03		

APPENDIX F (Cont'd)

Mean SC--Ante BAT

	SD	IV	NT
PRE	.0485	.0201	-.0025
	.0154	.0608	-.0127
	.0142	.0492	.0082
	-.0091	-.0174	-.0186
	.0277	.0329	.0272
	.0093	.0038	.0251
	.0393	-.0248	.0393
	.0248	.0068	-.0200
	.0435		.0584
	.0469		
POST	.0241	.0043	.0719
	.0161	-.0480	-.0417
	.0282	.0780	.0100
	-.0420	-.0001	.0700
	.1036	-.0564	.0262
	.0008	.0488	.0027
	.0216	-.0308	.0036
	.0392	.0314	.0018
	.0014		.0478
	.0289		